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Engineering Library

STEPHEN P. TIMOSHENKO

Dr. Timoshenko, the twelfth Lamme Medalist of the Society for the Promotion of Engineering Education, was born December 23, 1878, at Kiew, Russia. He was educated in the high school at Romni, Russia, 1889–1896; the Institute of Engineering of Ways of

Communication, St. Petersburg, 1896–1901; and at Gottingen, 1905–1906.

Dr. Timoshenko served in the Imperial Russian Army, 1901–1902. His educational career began at the Institute of Ways of Communication as an instructor in 1902. He was Assistant Professor, Polytechnical Institute, St. Petersburg, 1903–1906; Professor at the Polytechnical Institute at Kiew, 1907–1911; Professor at the Electrotechnical and Polytechnical Institute, Zagreb, Yugoslavia, 1920–1922. From 1923 to 1927, Dr. Timoshenko filled the position of Research and Consulting Engineer, Westinghouse Electric & Manufacturing Company, and was engaged in the teaching of advanced theory of elasticity in the Westinghouse Design School. During 1927, he was Westinghouse Lecturer in Applied Mechanics in the Graduate School of the University of Pittsburgh. He was Professor of Applied Mechanics at the University of Michigan, 1927–1936, and since 1936 has been Professor of Theoretical and Applied Mechanics at Stanford University.

Dr. Timoshenko is the author of the following books in English: "Applied Elasticity," "Vibration Problems in Engineering," "Strength of Materials," "Theory of Elasticity," "Theory of Elastic Stability." He is the author of more than fifty papers in other languages.

In addition to his relationship at Stanford, Dr. Timoshenko is a Consulting Engineer and member of the Advising Research Board, Westinghouse Electric & Manufacturing Company; a member of the A. S. M. E.; American Mathematical Society; S. A. E.; F. A. A. A. S.; a member of Verein Deutscher Ingenieure; Gesellschaft Angen. Mathematical Mechanics; Academy of Science at Kiew; Correspondent of the Academy of Science of St. Petersburg; a member of the "Akademia Nauk Technicznych," Warszawie.

Dr. Timoshenko married, in Russia in 1902, Alexandra M. Auhangelskaja. There are three children—Anna, Gregor, and Marina.

OLIN JEROME FERGUSON

President, Society for the Promotion of Engineering Education, 1939–40

Olin Jerome Ferguson was born November 21, 1875, in Annawan, Ill. He was educated in the high school at Dorchester, Nebr., B.S. in E.E., University of Nebraska, 1903; M.E.E., Union College, 1909. He was instructor of electrical engineering, 1905–07, assistant professor 1907–12 at Union College. In 1912 he went to the

OLIN JEROME FERGUSON

University of Nebraska as professor of electrical engineering and in 1920 assumed the duties of Dean of the College of Engineering, the position which he now holds.

Dean Ferguson has been a member of this Society since 1908. He has been one of the energetic workers in the Society giving his time freely to the promotion of engineering education. In 1923–24 he was Vice President.

President Ferguson is a member of the A. I. E. E., A. A. U. P., American Interprofessional Institute, A. A. A. S., Sigma Xi, and Sigma Tau. He is the author of "Elements of Electrical Transmission," and "Electric Lighting."

THERE IS SO MUCH TO DO

By O. J. FERGUSON

President of the Society

Engineering education has traveled a long, steep, and not too smooth path since the first engineering schools were organized in the nineteenth century. This Society has given nearly fifty years to the task of defining the objectives of engineering education and to improving its processes, and has accomplished much. Nevertheless, in 1922 so strong was our conviction of sin, especially the sin of omission, and so vocal the challenge of our John-the-Baptist, Chas. F. Scott, that we undertook a fundamental study of what was needed for our redemption. The study was honestly and deliberately planned, and painstakingly executed. Almost the whole personnel of the Society contributed to its fulfillment.

The reports upon engineering education which were so evolved constitute one of the most basic, intimate, complete, and sound studies ever made in any field of education. Never do we turn to its index without finding helpful material to guide us out of our puzzlements. Never do we peruse its pages without experiencing the joy of some unexpected discovery. Its sections are full of substance and counsel.

Do we wish statistics upon the various aspects of our profession? They are presented. Personnel data on students, graduates, teachers; curricula, and methods of instruction; supplementary services of engineering colleges; costs of engineering education; relationship of engineering education to the professions, and to industry; engineering education in Europe.

These main headings were subdivided until they reached into the details of admissions requirements, and selection and guidance procedures; elimination and mortality causes; placement of graduates and non-graduates; teachers' qualifications; engineering curricula; graduate work; the specially gifted student, and many, many other important items.

Nevertheless, in the great mass of detail, at no time was there lost to sight the prime aspects of the study—"to develop, broaden, and enrich engineering education." Continual attention was given to consideration of the objectives sought, and the fitness of our agencies to achieve proper ends.

It was a forward-looking study, and pointed to the meeting of new conditions, as evidenced by the paragraph in the report of the chairman:

> It is one thing to determine how the engineer should be trained to do the things which tradition and past practices have prescribed as his normal work. It is quite another thing to picture his place in the New Epoch which power and machinery, science and engineering and productive industry are initiating.

And now that a few years have passed since the issuance of the Board's reports, and we discern that the implications, the attributes, and the aspects of engineering education are continually changing and forever evolving new problems, we feel the need of the constant source of new information provided by our society activities. A fine way to recognize these developments is to study the work programs of our indefatigable committees, and our zealous divisions. The program of the annual meeting just closed at Penn State College provided over sixty conferences by committees or divisions, with specific topical programs. One full day and three half-days were allocated to these meetings. Discussions were had of departmental educational policies, teaching methods, accessories to instruction, examination procedures, industrial engineering, management, coöperative engineering education, technologies, sections and branches, relations with other engineering societies, etc. Important among these conferences were such as those on mathematics, physics, and English. Thus, many active members of the Society were carrying on, and the work of the investigation has no ending.

Nor should less importance be given to the invigorating meetings of the eighteen sections, which in their respective regions serve so definitely the local members, many of whom have therein their only contacts with S. P. E. E. conventions.

The recital of these facts brings nothing new to many of you. You have been aware of all of these yeastings. My object was not to inform. Rather would I base upon this review an appeal to all you who labor, to weary not in well doing; and to you who may not yet have had a part in the work, to enter into it with all the vigor and freshness of newcomers.

There is so much to do.—The challenging tasks confront us in such rapid succession that we seem at times to be losing ground rather than gaining. We are hampered by the meagerness or our knowledge of proper methods of student guidance and selection. We are embarrassed that we still have no clear concept of our responsibilities in other than full professional college courses. We are appalled to realize that our schools may not be financially

able to offer to all askers that much touted American ideal of unlimited educational advantages. We are humiliated by the impotence of our attempts further to implement engineering toward sound social progress.

To whom may we turn in these great straits? To whom—if not to the devoted members of S. P. E. E.? These problems are engineering tasks. They will be solved only by engineering leaders. Do we have these leaders?

I wonder if some future generation may not review our times and say of them, "There were giants in those days!"

ENGINEERING AND SOCIAL PROGRESS*

By KARL T. COMPTON

President, Society for the Promotion of Engineering Education; President, Massachusetts Institute of Technology

An English wit lately observed that since women have found they could talk about everything, they won't talk about anything else. I sometimes feel, now that engineers have begun to discuss the social aspects of engineering, that we too refuse to talk about anything else.

Lest this be taken as something more than a soft impeachment of an oratorical fashion, I hasten to emphasize that I am proud of this new voice of engineering, whether oratorical or not; proud of this growing insistence on a proper recognition of society's indebtedness to the engineer and the engineer's widening obligation to society. Out of this chorus of reiteration there must emerge a wider recognition among our own votaries that if engineering is to be a true profession it cannot be restricted to a plane surface of technical proficiency, but must embrace the third dimension of social responsibility and awareness. A profession must have this social roundness, solidity and depth if it is to be more than an intellectual trade lacking in survival value.

It is to this third dimension that the general sessions of this convention are dedicated, and as a prologue to the program I wish to contribute my own share of reiteration. George Meredith, the novelist, once spoke of "lapidary sentences with the value of chalk eggs, which lure the thinker to set." I shall be happy if my own sentences, even though infertile themselves, lure the thinkers here to a productive hatching.

The usual inventory of the engineer's contribution to social progress consists of an enumeration of his additions to mankind's material well being. At the risk of subjecting you to a "blinding glimpse of the obvious" let me draw upon this material inventory in order to introduce some less obvious contributions of the engineer.

We know for example that the people of the United States are served by the energy equivalent of one hundred slaves working twelve hours a day for each man, woman and child, and that this achievement in energy production has been attained with amazing rapidity. At the turn of the century the power used in this country

* Presidential address delivered at The Pennsylvania State College, June 19–23, 1939.

was approximately equivalent to two man power per capita. Our productive capacity has increased therefore fifty times in the past four decades. Now something more than power lurks in these statistics; there is a social achievement that is more important than the material achievement. Energy of course is wealth of the most fundamental sort. An increase in energy-wealth brings a higher standard of living. Since memory runneth not to the contrary, the peoples of the world have resorted to predatory methods for raising their standards of living. Wealth all too frequently has been obtained by taking something from someone else through conquest, excessive taxation, slavery, exploitation, or power politics. Today through the resourcefulness of the scientist and engineer in producing ever more abundant energy, we have for the first time in history a way of securing a more abundant life that does not require taking it away from someone else. By creating wealth and opportunity where they did not exist before, the engineer has struck a mighty blow against the primitive predatory instinct that breeds so much trouble between nations and between classes within nations.

Coming again to the material record, we find there a statistical essay in population growth. The Sub-committee on Technology of the National Resources Committee has estimated that between 1910 and 1930 the output per agricultural worker in America increased 41 per cent. In the year our Constitution was written the surplus food of nineteen farmers was required to feed one city person. Now in average years nineteen farm workers produce enough to feed fifty-six non-farm workers in America and ten abroad. The improvements reflected here in the technique of farming, plus the remarkable development of food technology in the last half century, through chemical, biological and engineering improvements in food preservation and transportation, have confounded the dicta of Malthus and removed the possibility of our population out-running its means of subsistence. Applied science has destroyed the bogey of famine, and has made possible a population greatly in excess of any which could have been supported in pre-engineering days.

Turning again to the material record, we may see that since Bell invented the 'phone in 1876 the telephone industry has grown into the third largest public utility in the United States, with an investment of nearly five billion dollars and an employment running to hundreds of thousands. Here is a great asset created without taking anything from anybody, which has profoundly affected our way of life. Modern communication has reduced the rigidity of boundaries, unified peoples, aided in safety and crime prevention and in myriad other ways changed the tenor of our living. It has brought us also, as Herbert Hoover recently remarked, jazz by night

and war scares by day, and between diverted our minds from other woes.

Or take two manufacturing industries in which the engineer has been a dominant figure, the automobile and the electrical industry. In 1900 Theodore Roosevelt received wide publicity for the courage he demonstrated by riding in an automobile. Thirty-five years later the Automobile Manufacturers' Association estimated that five million people were employed directly or indirectly by the automotive industry, and there was a passenger car for every five American people. The electrical industry has virtually come into existence in the past fifty years and in this period has grown from scratch until today it gives employment directly or indirectly to more than three million people. Here again the statistical facts reflect a great deal more than technical achievement. They mean that we have more of the conveniences and desiderata of life, that we work fewer hours to earn or make these things. They mean that free time is available for education, recreation, retirement for old age. They mean increased intellectual activity for all the people, a greater opportunity for cultivation of those spiritual and social qualities which are of major importance in life.

These few excerpts that I have drawn from the inventory of engineering progress are but symbols of what seems to me to be a more fundamental achievement—an advance in man's way of thinking, in his outlook on life. I speak of the scientific method and of the engineering mind. Historians, preoccupied with war, politics and economics, have virtually ignored the history of science and technology, and only in recent years have we gained a reasonable understanding of the origin and development of these powerful forces. When we reflect that it required thousands of years for man to evolve the experimental method, we gain increased appreciation of this great achievement. "Let us imagine," to use an illustration of James Harvey Robinson, "that 500,000 years of developing culture were compressed into 50 years. On this scale mankind would have required 49 years to learn enough to desert here and there his inveterate hunting habits and settle down in villages. Half through the fiftieth year writing was discovered and practiced within a very limited area, thus supplying one of the chief means for perpetuating and spreading culture. The achievements of the Greeks would be but three months work, the prevailing of Christianity two; the printing press would be a fortnight old and man would be using steam for hardly a week. The peculiar conditions under which we live did not come about until December 31 of the fiftieth year."

The way of thinking that has made modern science and engineering possible is thus relatively new in the life of man. On the fifty-

year scale it has been in full flower only a few weeks. In evaluating the social contributions of engineering we need to keep this in mind.

How did this way of thinking come about? It did not come easily and naturally, but evolved through much trial, error, and experience. The Greeks, for example, with all their brilliance and achievement, never developed an intellectual climate in which technology in the modern sense could flourish. To them science and philosophy were the same; they were not greatly concerned in rigorous observations of how and why things happen but rather in a speculative consideration of why and how they happen. They were bold in reasoning, but timid in coordinating logic with fact. They were brilliant in deductive generalization and were able to proceed far in mathematics, but their lack of interest in brute facts prevented their embryonic science from developing. "The Greek mind became entranced with its own creations," a condition that is analogous to the preoccupations of political minds in many countries today.

If the Greeks were too theoretical, the Romans were too practical. Cicero praised his countrymen because, thanks to the Gods, they were unlike the Greeks and limited the study of mathematics to practical ends. Aside from their achievements as rule-of-thumb engineers, their seminal contribution was to create through law and administration an ideal of order that later was to play its part in the development of the concept that Nature is orderly.

The magic and religion of the Dark Ages seem far removed from science, but they aided in creating an intellectual climate in which science could grow. Magic turned men's minds toward their external environment and the dream of conquering nature, while the religious life in the early monasteries emphasized order, discipline, and the ideal of craftsmanship. St. Benedict, in giving form to the great working order of Benedictines, stressed practical pursuits, and removed the social stigma from manual labor. As Whitehead has said, "The alliance of science with technology, by which learning is kept in contact with irreducible and stubborn facts, owes much to the practical bent of the Benedictines." This combination of mind and hand is one of the landmarks of engineering progress, and it is noteworthy that it is reflected in the motto "Mens et Manus," of my own institution.

The churchmen made other contributions, too infrequently recognized. In the thirteenth century the scholasticism of Thomas Aquinas, influenced by the science and logic of the rediscovered Aristotle, upheld the supremacy of reason and taught that nature is understandable. "The men of the Renaissance, when they founded modern science, owed this assumption to the Scholastics." * The

* W. C. D. Dampier-Whetham, "A History of Science."

same century that witnessed the great synthesis of Thomas Aquinas also brought the first clear expression of the experimental method. The Franciscan, Roger Bacon, anticipating by over three centuries the teaching of Francis Bacon, taught that knowledge must be based upon observation and experiment and not upon inference and argument.

Thus the ideas and interests of the Western World were conditioned and fertilized for the flourishing of the Renaissance. The logic of the Greeks, the orderly law of the Romans, the practical activities of the monks, the rationality of the scholastics, and the experimental doctrine of Roger Bacon were some of the cultural legacies that enabled Copernicus, Galileo, Newton and their successors to build the magnificent structure of knowledge and understanding that underlies modern science and technology.

Our engineering philosophy, with its fusion of the scientific method with practical application, is one of the greatest syntheses of the human mind, and the thousands of years and the strange confluences of ideas that have been required to produce it, when they are reviewed even in an oversimplified thumbnail sketch, engender a new feeling of the dignity and subtlety of the youthful profession we seek to promote. By the effectiveness of its method, engineering has won field after field, giving us new respect for mind, and greater power over matter and the unknown.

The historical perspective, along with the evidence we have of the present power of science and engineering to benefit mankind, emphasizes the challenge before us to preserve the engineering method as an essential element of civilization. It also emphasizes the importance of our carrying the synthesis still further so that engineering will be broad enough to cope with new social demands and humble enough to realize that it cannot survive without readapting itself to new conditions.

I do not mean that we should yield one iota in relying upon the efficacy of our time-proven methods. In the secure knowledge that the engineering approach has elevated mankind, even the common man, far above the previous level of drudgery and hopelessness, we must stand steadfast against the sort of intellectual disarmament called scientific holidays which timid men have proposed from time to time. We must likewise stand against those boldly insistent non-scientific ideologies which seek gain without labor and advocate hypotheses untested by irreducible and stubborn facts. All through history there have arisen prophets and mass movements based on wishful thinking rather than logic, labor and experience. They are rampant now, and it seems to me to be a duty of engineering to combat them, if for no other reason than to protect itself. Standing alone, engineering is well nigh powerless

to accomplish even engineering ends; it must have the right environment if it is to function effectively. Science and engineering flourish best in the clear daylight of free speech and where initiative and the urge to discover have not been restricted either by complacency or by suppression. If they are to be continued as social forces for good, these circumstances and these values, common both to science and democracy, must be preserved.

To be effective in preserving these qualities and circumstances it is important that engineers insist upon being something more than the docile hired men Veblen accused us of being. We must find ways, particularly under a democratic government, to bring our competence to bear on policy-making as well as on technical problems. Let me cite an example.

The recent public works program of the federal government has involved an enormous amount and value of engineering construction. In general the federal government has called on the best engineering talent in the country for help in the design and construction of these projects. This is notably true on the great dams where geological and engineering advice has been sought and followed, and where a great deal of high grade research has been carried on in order to make these projects as perfect as possible from an engineering standpoint.

The discouraging fact remains, however, that the federal government has notably refrained from calling on engineers for advice and guidance in the most important of all fields in which engineering advice is necessary, namely in determining the feasibility and economic justification of the projects themselves. This was notably true of the much-publicized Passamaquoddy and Florida Ship Canal projects. It is not so well known to be true of the Fort Peck Dam project which has no justification for flood control and the only economic justification of which is maintenance of a uniform depth of water level in the Missouri River between St. Louis and Kansas City. An engineering appraisal of this project shows that in addition to interest on the investment of the order of two million dollars a year, something like another million dollars a year will be required for maintenance of the channel for navigation, so that the actual cost to the country of the freight traffic which can presumably be anticipated by this route will probably be of the order of one thousand dollars per ton between the two cities. The excess of this amount over normal freight rates will of course be paid for by annual taxes. Examples like Passamaquoddy, the Florida Ship Canal, and Fort Peck Dam show that the public is paying enormous financial sums through permitting decision on such important technical projects to be made on the basis of political expediency rather than of sound engineering considerations. Democracy can ill afford

the waste which results from failure to utilize the resources of the engineering profession, nor can engineering afford in the long run to permit its talents to be misapplied.

While justly deploring this failure of political leaders to rely on sound engineering judgment, we must recognize that the engineering profession itself shares a portion of the responsibility. Mr. Frederick Allner of the American Engineering Council put his finger upon the difficulty when he said: "The same group of characteristics that qualify the engineer for favorable public attention seems to influence him to be reserved in his utterances, and to remain silent, even on subjects that concern the relationship of engineering to broad public questions. Or, putting it more bluntly, they may cause him to sidestep the responsibility of influencing public opinion at the right time and in the right manner. This attitude of aloofness is not in the very best interest of either the public or our profession. . . . We should always bear in mind that the real master of our destiny is that usually elusive, silent, imponderable, but at times loud and articulate, something known as public opinion."

If the engineer is to bring his influence to bear on broad public questions he must approach them, not with technical arrogance, but with sympathetic understanding. If he is to counsel the people he must gain the confidence of the people, and this confidence is obtained by placing ministry to the public above all other considerations. This concept of ministering to the public welfare, which is the concept underlying the professional attitude, is the remaining principle that needs to be fully synthesized with other elements that have been combined to form the engineering philosophy. As I said in the beginning, if we are to be a true profession we must embrace this third dimension of social responsibility and public service.

Buttressed by the dignity, altruism, and social responsibility of the true professional spirit, we can proceed with greatest confidence and effectiveness in applying engineering to the solution of the present urgent problems of our national welfare. America needs work for millions of unemployed. Science and engineering have the herculean job—and the capacity—to create and produce new products which people will work for and pay for to possess, and this is the only sound cure for unemployment. Our people crave protection against the perils of nature such as floods and earthquakes and droughts and against the man-made perils of transportation, fire, and group violence. This is primarily the job of the engineer. Wisdom urges us to seek conservation of our natural resources of soils, minerals and power. I need not describe to you the significant extent to which the engineer enters into this field not only in

construction, discovery and efficient utilization, but also in the evaluation of economic consequences. We need better housing, which means that engineers must design houses that can be made available to more people. Our people are striving for an improvement in our lagging distribution system, for higher wages, shorter hours of labor, a higher standard of living. Engineering research and engineering methods are essential for the attainment of these goals. Our people want industrial peace, and the engineer, because he stands, by virtue of his professional status, in an intermediate position between capital and labor, has a superlative opportunity to create mutual trust between these two groups.

Our society needs protection too against engineering itself, or at least against misused engineering. In the use of the radio and the airplane we see how false ideologies may employ the achievements of engineering to promote themselves by taking something away from someone else. The impact of new discoveries sometimes produces technological unemployment even though new discoveries must ultimately increase employment. Improperly used, the products of engineering may promote unrest, multiply hazards, increase congestion, and stimulate materialism corrosive to the human spirit. Engineering creates opportunities and man may use these opportunities to advantage or detriment. If the engineer is clear-headed and free from professional arrogance he will recognize that evils may result from his work and this recognition is a most important step in preventing these evils.

What other things should we as engineers and engineering educators strive for and teach in order that social progress may not be endangered by engineering but promoted in a desirable way? Let me, by way of summary and conclusion, suggest the things that seem to me to be timely and important.

Let us, first of all, lose no chance to stress the scientific method and its application by the engineer to social purposes. The conviction that Nature is orderly and understandable, the spirit of disinterested curiosity, the passion for truth, the subjecting of hypotheses to the test of irreducible and stubborn facts—these are the elements of the scientific method. Along with them go an unwillingness to manipulate truth for the sake of doctrine, a realization that it is impossible to get something for nothing, and that the skillful use of Nature's forces is the way to produce more. This scientific method, itself a synthesis of many intellectual currents as I have described, has been combined by the engineer with the principle of social utility to form the engineering philosophy, the philosophy of science in action for social purposes.

A better understanding of what the engineering philosophy comprehends prepares the way for a wider recognition of its achieve-

ments, and herein lies my second suggestion. Let us lose no chance to emphasize that our modern civilization owes its flourishing to the engineering philosophy, the most fruitful intellectual method and outlook in the world's history, and that a mis-use of it or a departure from it may easily plunge us into a new dark age. Let us also emphasize that the contributions of engineering have not been limited to material accomplishments, important as they have been. Its practical utility has been and will be of lesser consequence than its social and philosophical value. It has helped to make life itself a better thing. Through the moral values of its method, it has elevated our ethical standards. Through the effectiveness of its method, it has promoted confidence, giving us new comprehension, new respect for mind, and greater power over matter and the unknown with a consequent enhancement of the dignity of the human spirit. This dignity and self-confidence is essential if man is not to be a puppet but a citizen, free and freedom-loving.

The engineer has been too inclined to hide his light under a bushel when it should be shining in a light house. We have an opportunity to encourage a more sensitive and adequate exposition of the engineering philosophy and its benefits. I do not mean by this that the engineer must be a publicity seeker. I mean that he must be articulate in defense of his profession and courageous in advocating the use of its full capacities for the public welfare.

This Society has always been alert to the professional aspects of engineering and it now is participating in the most far-flung effort that has been made to elevate professional standards. My final suggestion is that we permit no diminution of this effort. The professional attitude is the precursor of social responsibility, the surest preventive against the creation of social hazards by engineers themselves.

We have here a more difficult problem than the other professions. We are broken up, logically to be sure, into many discrete groups, each highly specialized. The library catalogs recognize over fifty branches of engineering. No other profession has so much diversity. No other profession is so young or has such a rapidly changing subject matter. We thus lack the unity of law and medicine.

We have another handicap. The practicing engineer is not usually an independent consultant in the sense that most lawyers or doctors are. There are many consulting engineers, of course, but the great majority of our profession is allied with industry or engaged in business.

These conditions, it seems to me, greatly increase the need for a sound professional spirit among engineers. The opportunities to be unprofessional are greater; therefore the emphasis on a true

professional attitude is the more sorely needed. Certainly we have no reason to conclude that these difficulties preclude the professional spirit. "The essence of the professional status," as Gano Dunn has said, "lies in the moral obligation involved in the act of professing. This act is always personal; and it is in the engineer's personal relations to his fellows and to society, and the obligations therein involved . . . that his professional status resides."

Unless we can see that the engineer has this moral obligation to his fellows and to society "we may as well resign ourselves," as my former colleague Vannevar Bush recently told the Engineering Council, "to a gradual absorption as controlled employees. . . . We may as well conclude that we are merely one more group of the population, trained with a special skill . . . with no higher ideals than to serve as directed, and with no greater satisfaction than the securing of an adequate income."

I submit that the future of engineering is largely bound up with this struggle for a true professional spirit, and I submit, further, that engineering's continued contribution to social progress is likewise at stake. If society is to respect the engineer and to permit him to function effectively, it must recognize him as a professional man, animated by the precepts of the engineering philosophy, competent and authoritative in his art, and zealous in behalf of the ultimate welfare of the nation.

If we can insure these qualities, we need have no qualms about the future of engineering or its contributions to social progress, we need have no sense of inferiority as a profession, but instead an abiding faith in the dignity and importance of our work.

Petarch was once called civilized because he voluntarily climbed a mountain for the view in a day when men were satisfied with a worm's eye view. There are enough engineers and teachers today who seek the distant view to insure an aspiring engineering profession, and if their influence is properly brought to bear, if they are willing to speak up in meeting, I for one will be sure that for engineering the sun is just rising.

ADDRESS OF WELCOME

By DEAN H. P. HAMMOND

President Compton, Dr. Hetzel, members of the Society and friends: Securing a convention of this Society has become a matter of very keen competition. Every year, there are several institutions which strive strenuously to secure a meeting, sometimes several years in advance. I suspect the reasons for this are, first, that we like to show our friends the things we have, and the things we do; I suspect we like to repay hospitalities; but I suspect also that we like to welcome our friends and to play the part of host.

That is what we at Pennsylvania State College want to do this year. We want to play host to you, we want to show our friendliness, we want to make you comfortable, and we want to make this meeting as profitable as lies within our power. About a hundred and fifty of us have been working, some for over a year, preparing for this meeting, and there are now a hundred and fifty-odd people on this campus to whom you can appeal for advice or aid or whatever you may wish. Since that makes only about ten persons per committeeman, we should be able to serve you.

In any case, we welcome you here on behalf of the Pennsylvania State College, most cordially. Our whole wish is to make this meeting successful. If we succeed in any measure in that, we will be amply repaid. Thank you!

RESPONSE TO ADDRESS OF WELCOME

By PRESIDENT K. T. COMPTON

President Hetzel, Dean Hammond, I know that I express the feelings of the members of this Society when I express our appreciation to the Pennsylvania State College and to the members of the local committee for their hospitality and for the very fine arrangements which they have provided for us. It would be a perfectly normal thing for me to make that statement as a matter of formality, as President of this organization, but I do not make it as a matter of formality. I express the opinions that I have heard expressed by members of this Society in regard to their pleasure over the arrangements which have been provided here.

I am particularly happy that we were welcomed on behalf of Pennsylvania State College by our colleague, Dean Hammond, who has not only served this Society recently as President of the Society, but whose many years of very effective, devoted and unselfish service to the cause of engineering education have caused him to be respected and beloved by everyone in this profession.

ADDRESS *

By R. D. HETZEL,

President, The Pennsylvania State College

We are all deeply appreciative of the privilege of having members of our organization associated in the splendid work of this great Society. We are conscious of the enviable record for constructive accomplishment which graces your organization, and we are especially pleased that members of our staff have had a part in this, particularly that Dean Hammond is now so active, and that in the past we have had a splendid champion in Dean Sackett.

I am glad to know that the engineers have turned their attention to the subject of social progress, for I have great faith in their ability to solve problems with expedition, accuracy and finality. I am a little disturbed to discover that in order to deal with the social structure of contemporary life, they found it necessary to interrupt their healing ministry to the spiritual elements of our environment, which I understand the Society has recently been concerned with.

I have the disturbing impression that even the attention of the engineers has not finally and completely brought order and direction to the spiritual forces in their bearing and effect upon the conduct of modern men and their affairs. I can understand, however, that this Society is considerably handicapped in the prosecution of this splendid purpose by virtue of its association with this thing known as education. Engineering free to act in the exercise of its exact procedures is one thing, but engineering encumbered with the baggage and paraphernalia of education must find itself under severe handicap. The conviction is growing upon me that such an association is not only a serious impediment to action, but it may be fraught with a measure of danger. One is compelled to admire the idealism and the heroism which have committed the profession to this alliance, and to hope for the best.

It may not be out of order, however, to offer up a prayer that the clarity of objective and the exactness of procedure which have made the engineering profession the envy of all men who long for order and progress will not be too seriously impaired by this partnership. And we might also add a petition that its quite enviable reputation shall not be marred by the disrepute which seems now to attach to education. Those of us who live in Pennsylvania and

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have gone through the probe and the purge recently administered by the Carnegie Foundation for the Advancement of Teaching are probably over-sensitive in this matter, but we gather from the press and from our neighbors that education seems to be rather generally in disrepute.

I wish that those of us who do not enjoy the blessings of the engineer's clarity of mind and exactness of procedure could be helpful in better conditioning education for the part it should take in its alliance with your profession. Many alibis can be offered, but probably the most honest and helpful gesture that can be made is in the form of a confession of confusion. Education, like economics, like politics, and possibly like religion, finds itself in this hour of need sharing the general bewilderment.

It is difficult to determine just what is meant when we speak of education in these days. A review of the definitions which have been given by the seers and the prophets over the years adds to the uncertainty which obtains. It seems to be one of those terms which, as Stuart Chase recently pointed out, gives rise to concepts which vary as widely as do the interests and prejudices of those concerned with it. I find that these definitions run the gamut from one end to the other. There are those who think of education as being purely empirical in its nature, and there are those who conceive of it only in formal designs and procedures which must be applied with exactness from the cradle to the grave.

If we restrict definitions to the realm of current thinking, we find no less confusion of concept, but we do find one constant upon which minds seem to meet, and that is whatever education is, it is wrong. On this score there seems to be such universal and blessed harmony that unless one is on his guard, he is in danger of getting the impression that there now obtains such a measure of accord as must lead to harmonious remedial action. At this point, he is in for a measure of disillusion. Here all semblance of agreement and harmony is dissipated. Every school of thought has its remedies. Some of these trace back logically to the concept and the definition of education with which the group started its crusade, but in others, the medicine men are adding only din to confusion.

Neither time nor potential advantage justifies detailed rehearsal of the theories and procedures which characterize these various schools of thought. This company is quite familiar with most of them. There may be some measure of interest and possibly a little profit, however, in reviewing some of the more general characteristics which attach to two major philosophies, particularly as they seem to reflect contemporary thinking and motivate contemporary action.

To reduce major distinctions in the field to two categories is,

of course, an over-simplification which can be justified only as a last resort. I find, however, that one must assert himself at some point in order to avoid the confusion of profound scholarship on one hand, or the fanaticism of the zealot on the other, and this is particularly true of the administrator of a modern institution of higher education, who must provide for the support of both types of indulgence. He must have on the one hand understanding and sympathy with the ambitions, the trials and the tribulations of those who are trying to make education do the daily chores, and on the other, with those who have tied education to the stars. And so he finds himself most of the time with one foot on the ground and one in the air. Such a posture is apt, of course, to lead to a distorted angle of vision.

Those of us who view the current scene from this angle, and this I believe includes most of the laity, get the impression that the champions of education are divided into two large camps: those who believe that education is made of relatively earthy and rather tangible disciplines on the one hand, and on the other, those who conceive of it as a kind of spiritual ministry having to do with imagery and with forces and refinements whose nature and significance can be comprehended only by the anointed. Generally speaking, they place in the first camp the advocates of vocational education, the scientists, the technologists and members of the professions, these latter despite their early and close affiliation with the so-called traditional institutions of learning, and there is, I believe, a general disposition to think of the so-called progressive educators as belonging to this group, shocking as this may be to some of that fraternity.

Most of the realists seem to be enrolled in this group. The scientists are included, despite their claim of being concerned in large measure with explorations beyond the recognized frontiers of knowledge; and the technologists, including the engineers, are fixed in this setting beyond any possibility of release, despite their recent avowed interest in such intangibles as spiritual and social forces and disciplines. Despite the disparaging comments which emanate from the other camp, it is my impression that at this time at least these are the favorites of the great American public. Certainly, it is for their indulgence that the public purse is open most generously and with least protest.

In the other group are those who think of education mainly as a discipline of the mind. They believe that desirable objectives in all fields of interest may be obtained by cultivating and strengthening the intellectual powers. Emphasis is upon discipline, with the traditional subjects favored as the superior substances upon which to nourish the mind, and traditional procedures generally

accepted as best designed to provide the essential exercise. In varying degrees, the sciences have been accepted into this group, but rather cautiously, and generally only after their ancestry has been investigated thoroughly. The most recent test of eligibility seems to be whether or not they have made "the one hundred books."

This camp, with all of its eminently respectable personnel, its traditions, its idealism, its record of accomplishment, is firmly established and probably remains the dominant influence in the educational world. Just now it seems to be experiencing, if not enjoying, a kind of rejuvenation or revival, under the leadership of a group of vigorous and brilliant young men, who, if the magazines can be believed, recently have brought Socrates to America, staged a crossing of the Delaware for him, and with much fanfare, have established him in residence at St. John's College in Annapolis. This is a positive contribution.

It is to be hoped that in spite of this performance, this venerable and highly respectable contingent has not gone Hollywood. It should not go unnoticed, however, that this camp under its new leadership is not without a strong sense of modern showmanship.

This brief review, with its violations of logical order and its distortion of emphasis, is offered primarily to set the stage for a consideration of responsibilities which I think we now face. Those of us who are concerned with education in America are today facing as difficult and as challenging a task as obtains in any other field of interest, whether it be economics or politics or religion. We must quickly and efficiently adjust the educational resources at our command so as to minister constructively and adequately to a nation which not only is in the throes of internal adjustment but which at the same time is facing a threatening challenge from without. In these circumstances, there is no time or place for the indulgence of pride of concept, and there are no energies or resources available for waste in jurisdictional conflict. Education is called upon to muster its complete resources in the common cause.

If this is to be accomplished, there must be a re-emphasis upon national objectives and ideals. We must be made increasingly conscious that we are engaged in a struggle to preserve and to strengthen an organized society in which peace, justice and freedom shall prevail. To this task, every school of thought, every group, every camp, must dedicate its resources. Traditional education must give it sanction and guidance, and science and technology must give it substance and power. There must be no question as to the relative values of these contributions and there must be no raising of academic eyebrows when utility joins culture in a close and natural union designed to bring new unity and power to our nation.

The fact that this organization is most recently concerning itself with the spiritual and social aspects of contemporary life, and particularly with the place and significance which these have in the education of those who are preparing to enter the engineering profession, is appropriate and significant. The fact that this has not come earlier may be unfortunate, but it is not peculiar to engineering education alone.

American education, particularly in its upper ranks, has been too complacent and too self-satisfied for its own good and for the good of the American people. I would not absolve any field of interest from censure for this lag, but I would be disposed to be particularly critical of those of us who are concerned with the educational philosophies and procedures of the scientific and technical fields. I fear we have been so engrossed with the development of our skills and techniques and so intrigued with the magic which has developed under our hands, that we have forgotten for the moment that these things are not ends in themselves, but only the means to an end. We have been too little conscious of the fact that these disciplines have no meaning except as they strengthen and perfect our abilities to contribute to a worthwhile purpose, and that our discoveries and our inventions, spectacular as they may be, must in the last instance be judged as good or bad. If this is so, then it is of major importance that we give attention to the larger objectives and purposes toward which we must move lest we find ourselves off the road and guilty of wasting our resources in futile effort.

The wording of the theme for your discussions at this time, if it has been chosen deliberately, is most heartening. I gather that it has been determined either that the present social drift is progressive, or that engineering has resolved to be associated only with social movements which are positive in character and constructive in effect. Whether you are engaged in making appraisals or in drafting resolutions, your attitude deserves commendation. If I may be permitted to express a preference as between the two, it would be the hope that you are most concerned with making resolutions. I have no lack of faith in your capacity for making sound judgments, but I feel most the acute need in this day of mobilizing the potentially constructive forces, not only of education but of politics, of industry, of law, of religion, of every human resource, in support of what I believe must be a supreme effort to save democratic civilization.

I am not a pessimist; I believe that what needs to be done can be done. It will not be done by sitting supinely by, nor by thrusting our heads into the sand, nor by washing our hands of responsibility nor by selfishly pursuing our own designs and interests nor

by ignoring the unpleasant realities which face us. It will be done if we resolve that it shall be done, and if we put back of this resolution our total resources of skill, substance, knowledge and idealism.

This obligation rests with peculiar force upon those of us who are primarily concerned with the conditioning of youth. The most stupid and unfortunate error now being perpetrated, in large measure by those who are in positions of influence and leadership—and most of these, it must be confessed, are products of our educational processes—is the creation of the depressing and demoralizing, I might say the defeatist attitude, with which we are confronting youth. The atmosphere of this commencement period is surcharged with melancholy and despair. The joy, the high hopes, courage and faith, with which God has endowed youth, have been seriously impaired. This, I contend, is no proper function of education. It savors too much of maudlin emotionalism and it suggests too definitely the absence of faith in intelligence and in human character to receive the sanction of education, to say nothing of enlisting its active aid.

I hope you here are not only going to resolve that engineering education will henceforth lend its ministry to social progress, but that you will also declare that we are not bankrupt in those resources, present and potential, material, intellectual and spiritual, out of which an adjusted and strengthened democratic civilization can be molded. We owe this to the youth of our day.

We in America are concerned with *democratic* civilization. We have been born and bred in the ideals, traditions, institutions and processes of democracy. Democracy is a part of us and we are of the substance of democracy. Neither democracy nor true education can exist without the other. No society based on democratic principles can exist without the service of education, and by the same token, there can be no true education where the ideals, the inspirations, the ambitions, the guaranties and the safeguards of a democratic society and a liberal government do not exist. The logic of this vital interdependence has been strengthened and confirmed during every epoch of our national existence. It is as vital today as it ever has been.

If there is this intimacy between education and democracy, then neither can be ignorant of or without concern for the fortunes of the other. Democracy is going through a period of trial and tribulation. Our own nation is experiencing a period of major adjustment within, and is at the same time sharing with all democratic nations a threat from without. I shall not discuss the latter, because I assume that there is but one attitude and one answer to it, namely, that American education stands firmly and unqualifiedly

committed to the ideals, the principles and the institutions of democracy.

When we turn to the internal problems, we find less unanimity, not in loyalty to the major concept, but in judgment as to ways and means of attaining our objective. To say that this is a weakness of democracy is error; it is democracy. It is the self-respecting man, seeking without arbitrary restraint to find and to establish those conditions and practices and institutions which in his judgment seem best designed to enrich his life. But men do not live their lives alone, and society is not static. Within a single century, we have grown from a small group to one of the largest nations in the world. We have been transformed from an agrarian economy to an industrial economy, from a rural people to an urban people. We have amalgamated races of widely divergent backgrounds, traditions, political concepts and religions. We have fought wars and we have taken our place in the councils of nations. This has not been an experience free from strain and distress. But I know of no period that did not have its moments of deep concern. I wonder if, in truth, that which is greatest in our rich heritage may not be the strength, the courage, the skill, the knowledge and the faith which have come to us out of this great experience?

We face new and difficult problems, but I can see no reason why this should send us into a panic. To fear inordinately would be to reverse every tradition of our nation, and to confess inadequacy of genius and resources would be to deny an inheritance which has been too firmly established to permit of such default.

It is at this point that American education should become most sensitive to the challenge. If we no longer possess the skill, courage and wisdom to meet and to dispose of new problems constructively, education has failed to fulfill its responsibilities. We face new social problems because the social structure, like the animal kingdom, is a living and changing thing. Some of them, such as that of a declining population, will be formidable and they will bring with them new economic and new political issues. But why should a nation that has dealt with slavery and prohibition and survived the agonies of civil war fear to grapple with them? If education should go into a stalemate, if it should lose its vision or its courage or its freedom of action, we should then have grounds for concern. Or if education should waste its substance and blunt its skills in internal controversy over methods or jurisdictions, there might be cause for alarm. But despite, or possibly because of, the searing self-criticism to which we regularly subject ourselves, I think it can be said that no nation has ever had an educational system so comprehensive, so sympathetically adjusted to its needs, so alert and so resourceful as that which now obtains in this country. I

do not mean that there is not room for improvement, but I do believe that the direction of change is quite constantly in the line of betterment, and I believe, too, that there is now evident in educational thought an increasing emphasis upon the great economic, social, political and moral principles which underlie democracy. Your leadership in this significant shift of emphasis is both timely and commendable.

And so, as education more definitely mobilizes its forces in response to contemporary national needs, I am without serious concern either as to their adequacy or their loyalty. I have confidence in the ability and the devotion of educational leadership. With John Dewey and Charles Beard and Karl Compton on the board of strategy, I am willing to have Bob Hutchins wear the bearskin hat and swing the baton.

SOCIAL RESPONSIBILITY OF THE ENGINEER*

By ROBERT E. DOHERTY

President, Carnegie Institute of Technology

Whether engineers should assume a larger measure of social responsibility has been debated extensively during the last decade with practical results that are not impressive, yet there appears to be significant crystallization of professed opinion. While the view still lingers here and there that the engineer should stick to his technical knitting, letting other professional men worry about the social consequences of his work, there is nevertheless a pervasive and growing opinion that he should play a more active part in the social realm and that his educational preparation should take this aim into account. However, the extent of the discussion and of apparent agreement upon this point is out of all proportion to the practical results as measured either by active participation or by changes in educational programs looking to participation. Progress seems to be stymied biologically; after professional maturity, we seem to exhibit a certain elasticity of professed view but tend nevertheless to cling tenaciously to established habits. Not having participated, we don't start. Thus as a profession of engineers and educators we seem to agree upon a principle, and more or less let it go at that.

There is significant evidence of this attitude. While a few national engineering societies appear interested in social values that might come from united effort, others seem indifferent. Witness the precarious status of the American Engineering Council, which is withering from lack of support; yet it represents the only national medium through which the engineering profession as a whole can serve national welfare as well as its own interests. And it is my understanding that the Council has done a good job within its means. Another example is the Engineers' Council for Professional Development. This is the only organization that is constituted by proper representation to lift the engineering profession on all fronts to the level that it deserves and that we all wish for. And it has made measurable beginnings in four important directions, as presumably you all know. Yet the reservations with which some engineering societies enter it indicate a significant atti-

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tude of self-sufficiency. Naturally it is not for me to question in the least their full right to any attitude they wish to assume. I am merely citing it as evidence to my point that the engineering profession, although tending to agree that the engineer's station in society should be higher and his responsibility greater, has not yet reached the point of doing much about it. Neither has the teaching profession, as a glance at engineering curricula will indicate. A few show some revision toward the end of greater social and humane understanding, but by and large the portion of the curriculum assigned to this end is distressingly meagre. Status quo tends to persist.

Meantime national life proceeds more and more precariously. While we tire of hearing tales of woe, the ugly fact is that strife and confusion characterize the American scene. Pressure groups fight for selfish advantage; political demigogs try to out-do each other in leading raids upon the public treasury; labor fights with employers and with itself; and government and business are at loggerheads. Although Theodore Roosevelt invented the "square deal," Woodrow Wilson the "new freedom," Hoover the "new era," and Franklin Roosevelt the "new deal," nevertheless after a generation of political discovery and invention, the American people have become more baffled than ever in their efforts to incorporate the vast discoveries and inventions of science into their scheme of living so that they might realize in peaceful, prosperous, and happy lives, the limitless potentialities of these intellectual and material achievements. Individuals, groups, classes, and nations quarrel over the division of limited production instead of cooperating to provide an abundance for all; and they wantonly squander existing values and mortgage those of the future. Youth is discouraged; business men are confounded; trustees of great endowments don't know what to do; men without funds and men without work don't know what to do; nobody knows what to do!

What is the outlook? One's optimism is, I realize, likely to be adversely conditioned by immediate circumstances such as those I have just mentioned. On the other hand, the mere exhibition of optimism unfortunately is not very fruitful in an analysis; and whistling in the dark will not stop the lurking gangster. So at least for the next few minutes I may appear to assume the rôle of the pessimist, for I must confess that within my limited view there is little promise of long-range social felicity unless I postulate some new element that is not yet manifest in the body politic.

History is not reassuring. In his article "Are Revolutions Necessary?" historian Guy Stanton Ford, now President of Minnesota, said this: "To the question 'Must short-time and long-time changes end always in conflict and violence?' the historian can only

answer with certainty that the clash between beneficiaries of the existing order and exasperated advocates of change has always so ended. Each time, resistance to modest reform is blind to the wisdom of concession and the necessity of change. If concessions are made, they come too late. The demands have risen and the price of peace is again too high, only to become again too cheap. The reactionary breeds the radical among reformers, the approaching conflict falls under the leadership of these two opposing extremes, and the conflict follows. The process has been repeated so often in so many fields that it appears inevitable and, historically speaking, necessary.

"Have we before us any hope that mankind has, after all these centuries, learned a way to make without violent dislocation the necessary readjustments in his relations to his material environment and his fellow man?"

To President Ford's answer that there may be hope if we can learn to be tolerant and maintain the sanctity of free press, free speech, and the scholar's immunity to pursue truth, I would add two other essentials: (1) that we learn to make practical use of a new power within our reach that the generations of history did not have—the power of reasonable prediction that may come from the scientific method if it be applied to social and economic problems with the same intelligence as it has been applied during the last few generations to physical problems; and (2) that in our democracy we find a way to accomplish widespread social interest and understanding among professional men. Tolerance is necessary, but understanding there must be also; the issues even in their simplest forms become too much for most untrained, uninformed minds. There must be here and there among the masses cultivated intellects that can understand and give support to informed decision. And there must be in the councils of the state and nation not merely professional expertness, but expertness fortified by broad social understanding and a willingness to coöperate.

I am clear that there is no political panacea for our woes. Many feel that a less severe attitude by the national administration would be helpful, but I am confident that neither such an attitude nor a change of administration would solve the problem, because at bottom it is not political. It existed before the present administration came to office and will continue when a new administration comes to power. Social forces of the character and magnitude of those which now press us are not to be controlled by the fickle furor of partisan politics. Oscillating like a mighty, sweeping pendulum, they swing us back and forth with ever increasing violence between glut and poverty. And it will take more than political oratory to deal with the situation.

The job of professional statesmanship is to see that an end be put to the political hand-to-mouth method of dealing with social problems, and that these be recognized and attacked early enough and intelligently enough so that people's minds may become *gradually* accustomed to the new ideas involved. Then perhaps necessary change may be effected without violence and chaos. It is my purpose during the next few minutes to outline how I think engineers should enter this situation: why they should assume greater social responsibility, what it might be, and how their active interest might be won.

The fundamental ground on which I believe engineers should assume greater social responsibility is the fact that, after all, we live in a democracy. I have found it difficult to elicit interest in this idea because there is a widespread inclination to regard allusions to democracy and competent citizenship as sentimental vapor —as something nice to talk about, especially on flag day, but not in serious meetings of the kind I take this to be. Such matters are left largely to primary and secondary schools. But I do hope we can set aside such insidious prejudices if we have them, because there is involved here a deeper significance than momentary patriotic fervor; a greater responsibility, especially for professional men, than merely voting, accepting majority rule, and understanding the machinery of government. Our question transcends these; it strikes at the heart of the matter. Lifted out of the welter of confusing elements, the question we must answer is whether in our thinking and planning in connection with the future of engineering and engineering education in this country we are ready sincerely to accept as a philosophical basis the principle of democracy. If we are not, then I recommend that we prepare our exit. If we are, then we are obliged, if we be rational, to accept the implications.

These are simple. If the people or their representatives are to settle questions of state and national concern, then certainly they must be competent to do so or the whole system becomes a farce. Indeed it appears already to be approaching this. Issues have become too complex for the masses to understand; indeed they have become too complex for those whose business it is to understand and deal with them. By the very nature of the case, therefore, if we accept the theory of democracy we must accept also the proposition that there should be available to government at all its levels intelligent understanding and competence to deal with problems of statesmanship that have to be solved.

Such competence in a democracy cannot be confined to a capacity for balancing the relative advantages of different courses of action and approving that course which appears best; it must in-

clude as well competence in the use of present-day facilities for making these alternatives understandable to the voters by whom basic issues are decided. This requirement carries the problem into a field which scientifically trained men are frequently reluctant to enter—that of publicity and propaganda. But unless educated citizens are prepared to make themselves competent in the field for the benefit of society at large, their efforts, no matter how wisely conceived, will be overwhelmed by the propaganda of pressure groups who pursue selfish interests and who frequently have the skill to clothe these interests in the robes of patriotism and public welfare. Educated citizens must learn to explain social problems as well as to solve them.

To my mind, therefore, acceptance of the principle of democracy implies a new emphasis in education and a new sense of responsibility of citizenship on the part of professional men, not only as individuals but also as organized professional groups. It seems to me necessary that there be a pervasive infiltration among the citizenry, of professional people who will have become socially literate and who will feel the responsibility that goes with advantage and privilege; and further that professional groups hold constantly and preëminently in view their status as organic units of a democracy now under stress and their responsibility to help save it for future generations.

Then there are other grounds, I contend, why engineers have an especial responsibility. In proposing these grounds, however, I hope I need not disclaim the supposition that engineers are self-righteous and endowed with special intellectual gifts and that therefore as a professional group they are the hope of the world. There are, however, two special facts regarding engineers that place them in a unique position, and I need do no more than mention them to this audience. One is that the very nature of their professional work affects social organization. For example, in industrial management where they hold forth, social and economic problems loom large. Moreover, their technical achievements are associated with the origin of basic social problems—for instance, immediate technological unemployment and the rapid, fundamental alteration of the physical environment of society. Thus being the authors of, and therefore intimately understanding, the causes themselves, they should be in an advantageous position to learn how to control the effects.

The other special fact is the effectiveness of the engineer's method. The care and objectivity with which he approaches a problem, his insistence upon understanding its elements as far as may be practicable before deciding upon plans, the impartiality of his decisions, the firmness of his execution—these are certainly

something to be desired in social and economic affairs. The discipline of dealing with facts and principles that demonstrate themselves—sometimes publicly, if the bridge fails—has been widely and justly praised as a commendable attribute of the engineer's calling. So I am only repeating a commonplace when I propose that there is undoubtedly something in the engineering method, the scientific method, that is wanting in many social procedures and that could with great profit be exercised there. But believing this, I yet know that it would be putting the doctrine of transfer of ability to severe stress to move the engineer with his present knowledge and method over into the social realm without an appropriate leavening of his mind with humane appreciation and social understanding. But with this, I am confident that his method would greatly reinforce the attack upon those social problems that are related to his fields, or are a part of them.

Thus his method and the social implications of his work are cogent reasons for his assuming greater social responsibility; and added to these is the fundamental proposition that responsibility is doubly implied in democracy—through his citizenship and his organized professional connections.

What might that responsibility be? In what ways might the engineer become socially more serviceable? I have already indicated this in general terms. To be more specific brings one close to the realm of speculation. What, for instance, might the engineer actually do as an educated citizen? Just what every other educated citizen should do: keep informed regarding public issues, arrive at intelligent convictions, and give these as forceful expressions as possible by such means as may be at his command. These means obviously include active coöperation with other citizens in the promotion of causes which appear sound; helping the masses understand; and taking a much more extensive hand in public service in his local community, or in state or national affairs.

Moreover, engineers are increasingly forced to assume social responsibilities incident to their professional service. Managers and promotors of new technical undertakings must, willy-nilly, take account of the social consequences of alternative approaches to problems which have to be solved, and because the social and the technical aspects of these problems are interwoven, the two must be handled concurrently. The engineer who is blind to the social implications of his work is a less efficient engineer when social problems are involved than the one whose analysis includes necessary social factors, because whether we like it or not these have become a part of engineering activity. The engineer's achievements in management on the material, technical, and economic sides have been magnificent, and he has frequently rendered

notable service on the social side of his undertakings. In other cases, however, social ills, avoidable and unavoidable, have accompanied engineering progress, and it has become clear that the engineer has an important responsibility in helping to ameliorate these conditions. And in the midst of management he certainly is in a most favorable location to do so.

And finally as a member of organized engineering groups he might together with his colleagues exert telling influence upon important national problems. Most certainly in those which involve engineering elements he should have a strong voice in the forming of policy as well as the responsibility for technical plans. And more general still, he should be represented on equal footing with other professions on commissions and councils of government that might work out intelligent recommendations regarding long-range policy on which legislative bodies or administrations might act. In other words, wherever intelligent group procedure is required in connection with the problems of the democracy, the engineer should be represented.

But what can be said of the view one occasionally meets that the engineer's business is engineering, and that social and economic matters should be left to the social scientist? There is no berth in my mind for this opinion for two reasons: it stretches too far the theory of the division of labor, and it contravenes the principle of democracy. Experience proves division of labor to be sound in the building of a gun or automobile, but not where the business is settling what human relationships and human interests should be. It is one thing to have the several operations of shaping and assembling material parts done independently by different individuals according to an organized plan, and quite another to try to make the general plan itself by that method. And this is what we are discussing. Of course we should say that the strictly technical business of the social scientist should be done by him, of the engineer by the engineer, and of every other profession by that profession. But there are two things we must not do. We must not try to bound professional fields by straight lines when the boundaries are inherently irregular zones; rather we must articulate effectively those protruding areas at the boundary that should extend continuously from one field to another so that the whole pattern might represent an integrated, organic, social unit. And secondly we must not confuse expertness in a particular field with qualification for forming general judgments as to social policy and plan. The medical profession should not itself decide whether we should have socialized medicine, but it should submit to a representative professional body the technical implications of such a policy; the legal profession should not itself decide upon

laws, but certainly should deal with the technical business involved in their preparation and interpretation; the engineering profession should not itself decide whether we should have T.V.A., but certainly should make and interpret the results of its calculations; and the social scientist should not decide whether we should have a Federal Housing Authority, but should obviously make and submit his technical findings in relation thereto. Each profession must of course be responsible for technical expertness, and up to this point the theory of the division of labor is applicable; but no profession can be depended upon alone for judgments that involve interests and factors extending beyond its purview. And since there is not a super-profession—for most of us do not accord to social scientists this distinction—to which can be assigned the job of forming over-all judgments and framing recommendations of wise policy and plan, the theory of the division of labor is found wanting at that point. Anyway, in a democracy who is the social scientist to determine alone what social policy and plan should be? who the engineer? the business man? who indeed? None is competent. The job is too big, the ramifications of interest too extensive. But even if one were competent, it would contravene the principle of democracy to have proposed policy arrived at that way. Without a super-profession, and presumably without a dictator, to do our thinking for us, and yet with problems of social policy and plan so complex that expert professional thinking must be given to them, we are, it seems to me, inevitably committed to the more clumsy but democratic scheme of conference or council for reaching intelligent proposals that the people, or legislative groups, might have confidence in. Thus such councils would provide technical expertness, balance of interests, and the effective joining of boundary connections between related fields of social activity. All of these are essential, and they cannot be achieved through the policy of professional isolation. The engineer cannot delegate his responsibility to the social scientist.

But it is idle to talk about social responsibilities which the engineer might assume unless there be some prospect of getting him interested. This is the crux of the matter. I do not have the answer, but I do have a theory. I am clear, in the first place, that there is very little prospect of getting him actively interested by talk. Discussion and exhortation seem ineffectual in exciting in mature man a new interest—one that will bring action along a line fundamentally different from that of the past. Why this is so is a matter for the biologist and psychologist; the explanation is not important here, but the fact itself is. Hence I see only little hope

in discussion; most mature men are going to continue doing what they have done.

My theory is that active interest will follow competence. Given understanding and intellectual competence in the matter, interest will follow. If my observations are trustworthy, graduates follow essentially the interests they have cultivated in college; if not those within the immediate boundaries of the profession itself, then at least those of both subject matter and method which in college demanded a significant part of their attention. For illustration, in law such matters as social relationships and organization, business, finance, and discipline in careful statement are matters associated directly with the study of law itself. Graduates of law persue legal practice, but they also gravitate to general management, politics, and banking. In medicine, on the other hand, there is little that is associated with the study of this field that is, at the same time, related so directly to fields outside the profession itself. And graduates of medicine, forming perhaps the most closely knit of the professions, stick close to medicine. And in engineering, again we have diversity. Planning based on clear-headed, objective study and calculation, and the execution of plans, all in connection with material things—these have characterized the dominant interests of engineering students. And the graduates engage not only in their technical pursuits, but also in industrial management and business. The question may be legitimately raised whether particular interests are pursued in college and afterwards because they are inherent, or whether pursuit in college creates the interest. But the question has little point. The inference we have drawn is that whether the interest exists beforehand or is created, it is nevertheless cultivated in college and this cultivation profoundly influences the direction of later activity.

Here at least is a theory as to how the engineer's interest might be won. It means turning to youth; it means turning to education. If it is essential to the maintenance of a democratic society and to progress in solving baffling social problems to have the talents and the active citizenship of engineers focused upon those problems, habits must be formed in college, interests stimulated, and competences developed which will enable the engineer to coöperate naturally and effectively with educated citizens from other fields who are working toward the same ends.

This theory places responsibility for the initial step in the process squarely upon the shoulders of engineering educators, and this is a heavy and pointed responsibility. The initial step is difficult to take for reasons I have already stated, but unless we are to be in the position of shirking responsibility and of drifting in the face of danger under a policy of technical self-sufficiency, we

must act. We must provide in the curriculum enough time and sufficient guidance of the right kind so that our engineering students will have reasonable opportunity to prepare themselves for the responsibilities they will meet in the day they reach professional maturity. If our national situation is difficult to understand and deal with, theirs will be more so; and we must help them get ready.

I need not repeat here the difficulties involved in the fundamental revision of the curriculum. Inadequate time, rigidity of view, vested interest, unwarranted insistence upon specialized skills and knowledge—all of these loom ominously at the first move toward change. I know what they are. But I am clear that we can immensely improve engineering education toward the ends of social understanding and at the same time toward the ends of engineering science and method, and still keep the process within the present framework of undergraduate and graduate study.

I have just said that the responsibility upon engineering educators is heavy and pointed. Other professions may permit the creeping ossification of view to blind them in their mature years to the necessity of change and readjustment, but if this country is to emerge from chaos and endure as a democracy, as a land of free men, then each new professional generation must not be nurtured in the same atmosphere and professional lore as their fathers and grandfathers but in the light and knowledge and purpose of their own day. And if this is to be so, then the teaching profession must make it so. The responsibility cannot be evaded.

MINUTES OF THE MEETINGS OF COUNCIL

June 19–23, 1939

Present.—K. T. Compton, G. W. Case, M. L. Enger, W. O. Wiley, F. L. Bishop, O. W. Eshbach, H. J. Gilkey, F. W. Marquis, R. W. Morton, R. L. Sweigert, G. F. Eckhard, F. M. Feiker, S. C. Hollister, F. B. Seely, A. H. White, H. H. Armsby, H. T. Heald, W. B. Plank, J. S. Thompson, R. B. Wiley, D. C. Jackson, F. E. Turneaure, A. N. Talbot, A. M. Greene, C. F. Scott, A. A. Potter, R. L. Sackett, D. S. Kimball, R. A. Seaton, W. E. Wickenden, C. C. Williams, H. P. Hammond, and S. B. Earle (33).

President Hetzel welcomed the Council, members and guests to The Pennsylvania State College.

The report of the Treasurer, W. O. Wiley, was read and accepted.

The report of the Secretary, F. L. Bishop, was read and accepted.

The agenda containing items of policy only is to be sent to the members of Council prior to the meetings.

The new form of the year book was approved.

The Nominating Committee is to be listed under committees in the year book but not names—the reference to be that all past presidents and those members of Council whose terms expire the year following the meeting are members of the Committee.

Financing Sections.—Motion passed that the dues shall be $5.00 for individual members for 1939–40 and that no money shall be paid to sections.

Contribution to Engineers' Council for Professional Development.—Motion passed that this Society contribute $100.00 to the operating expenses of E. C. P. D. for its present fiscal year and that $500.00 be appropriated for the work of the Committee on Engineering Schools.

Engineering: A Career—A Culture.—Dean Sackett, Chairman of the Committee on the Selection and Guidance of E. C. P. D., reviewed the history and the use of this pamphlet. A year and a half has been devoted to its revision. It is now ready for final criticism and improvement. E. C. P. D. has no funds for its publication. The Society appointed the following committee to consider the improvement of the booklet and ways and means of publication, if such should be deemed advisable: D. S. Kimball, *Chairman,* H. H. Armsby, R. L. Sweigert, J. S. Thompson, R. B. Wiley, W. O. Wiley, B. M. Woods, and F. L. Bishop, *ex officio.*

Length of Meeting.—President Compton suggested that Council appraise this meeting and make recommendations to the Program Committee for next year.

Extra-curricular Activities. Committee.—Council authorized the appointment of such a committee to study the place, control, and effectiveness of these activities in giving the prospective engineer a broad, cultural, social and economic viewpoint.

The dates for the **1940 meeting** were set for June 25–28 at the University of California.

1941 Meeting.—The Committee on Relations with Engineering Societies recommended that this meeting be held in the Midwest. Invitations had been received from the University of Iowa, University of Michigan, and the University of Minnesota. Council voted to hold this meeting at the University of Michigan, June 23–27.

1942 Meeting.—An invitation was received from all the engineering schools in New York City. No action taken at this time.

American Council on Education.—W. E. Wickenden re-appointed a representative from this Society.

Engineers' Council for Professional Development.—R. A. Seaton re-appointed a representative from this Society.

The application for a branch at Northeastern University approved.

Committee on Progress.—Chas. F. Scott reported for this committee. Motion passed that the committee consider sub-dividing the report changing the title (current history suggested) and that the report be published, if possible, in the journals of the national engineering societies.

Study of Engineering Education.—D. C. Jackson reported that this is a report of about 40,000 words of text and some 22 charts and 14 tables, the charts and tables relating to specific data developed by the Committee on Engineering Schools (E. C. P. D.) in its accrediting project, and some collateral sources of information. The text lays the foundation for outlining the present status of engineering education by an examination of certain former reports and then considering the change of recent years. Trends are then outlined as a consequence of observing the influence of the changes as set forth, and also from direct information coming from various institutions and individuals. The publication of the report is in the hands of the E. C. P. D. Committee on Engineering Schools with funds provided by the Carnegie Foundation for the Advancement of Teaching. The publication is expected to include, as an appendix, a fine digest of the history of the work of accrediting carried on by the Committee on Engineering Schools written by

Allan W. Horton, Jr., who was Secretary of the Committee through a large part of its life to date.

Committee on Institutional Membership.—R. A. Seaton reported that transfers from associate to active institutional membership in the Society during the past year included the Catholic University of America, the Colorado State College, and the New Mexico State College. No institutional members were transferred from active to associate status.

Elections to associate institutional membership included Bliss Electrical School and the Eastern New Mexico Junior College. Elections to active membership included Northwestern University, the American Institute of Chemical Engineers, and the American Society of Civil Engineers.

Correspondence was carried on with several other institutions and organizations but no other applications than those noted above were received and none is awaiting action by the Committee or the Council.

Committee on English.—Chairman E. C. Elliott reported progress on the survey of English and the report will be printed in the JOURNAL OF ENGINEERING EDUCATION.

National Council of State Boards of Engineering Examiners.—Chas. F. Scott was appointed the representative of this Society at the meeting of this group in San Francisco in July.

Student Membership in the Society.—Council passed a motion authorizing the appointment of a committee to study this type of membership.

Council approved the action of the Executive Committee in granting permission to the **American Institute of Chemical Engineers** to publish the papers of the conference and of the summer school on chemical engineering and to sell them at cost without any expense to this Society.

Reserve Account.—Council passed a motion to the effect that it is the sense of that body that no funds be taken from the savings account of the Society without approval of Council. This makes the savings account a reserve account which cannot be touched without permission of the Council.

Budget.—The following budget was approved for 1939–40:

Receipts:			
Current dues: individuals		$12,000.00	
institutions		2,160.00	$14,160.00
Back dues			700.00
Advertising			2,500.00
Sale of publications and emblems			450.00
			$17,810.00
Disbursements:			
Meeting		850.00	
JOURNAL and *Proceedings*		7,800.00	
Committees and conferences		500.00	
Honorarium of Secretary		2,000.00	
Clerical assistance		4,000.00	
Sundry printing		300.00	
Postage, telephone and telegraph		600.00	
Contingent fund		300.00	
Travel, Secretary's office		400.00	
Dues: American Council on Education	$100		
American Engineering Council	250	350.00	
Contribution to E. C. P. D.			
Operating expense	100		
Committee Engineering Schools	500	600.00	$17,700.00
Estimated surplus			$ 110.00

33 new members were elected to individual membership:

Anderson, Henry C., Dean, College of Engineering, University of Michigan, Ann Arbor, Mich.

Bolotsky, Max, Graduate Student in Metallurgy, Missouri School of Mines, Rolla, Mo.

Borgman, William M., Assistant Professor of Mathematics, Wayne University, Detroit, Mich.

Bridgman, Donald S., Staff Assistant in Personnel Relations, American Tel. & Tel. Co., 195 Broadway, New York City.

Colyer, Edward E., Professor and Head, Dept. of Mathematics. Fort Hays Kansas State College, Hays, Kansas.

Coons, Kenneth W., Instructor in Chemical and Metallurgical Engineering, University of Alabama, University, Ala.

Fischer, Frederic P., Instructor in Electrical Engineering, Massachusetts Institute of Technology, Cambridge, Mass.

Flanders, Milton M., Dean of Faculty, Bliss Electrical School, Takoma Park, Washington, D. C.

Fuller, Landon E., Assistant Professor of English, Virginia Polytechnic Institute, Blacksburg, Va.

Glasgow, Roy S., Professor of Electrical Engineering, Washington University, St. Louis, Mo.

Hatch, Wm. Ernest, Instructor in Mathematics, Drawing and Science, School of Science, Hyannis, Mass.

Hodgins, Lawrence J., Associate Professor of Electrical Engineering, University of Maryland, College Park, Md.

Jones, Lawrence D., Associate Professor of Engineering Drawing, Ohio State University, Columbus, Ohio.

Lutz, Samuel G., Assistant Professor of Electrical Engineering, Southern Methodist University, Dallas, Texas.

McCully, Harry M., Instructor in Graphics and Engineering Drawing, Princeton University, Princeton, N. J.

McIntyre, H. J., Associate Professor of Mechanical Engineering, University of Washington, Seattle, Wash.

Megeath, Samuel A., Professor of Pre-Engineering, Spokane Junior College, Spokane, Wash.

Montague, Edwin N., Senior Specialist and Chief of Section, Field Operations and Training, U. S. Dept. of Labor, Washington, D. C.

Mosher, S. W., Engineering Executive, Municipal Civil Service Commission, Municipal Building, New York City.

Nelson, Alfred L., Professor of Mathematics, Wayne University, Detroit, Mich.

Porter, David J., Assistant Professor of Chemical Engineering, University of Missouri, Columbia, Mo.

Praeger, Emil, Professor and Head, Dept. of Civil Engineering, Rensselaer Polytechnic Institute, Troy, N. Y.

Schrenk, Walter T., Professor and Head, Dept. of Chemical Engineering and Chemistry, Missouri School of Mines, Rolla, Mo.

Schutz, Philip W., Instructor in Chemical Engineering, State College of Washington, Pullman, Wash.

Sherrill, Dana D., Instructor in Machine Design, Cornell University, Ithaca, N. Y.

Smith, Victor G., Associate Professor of Electrical Engineering, University of Toronto, Toronto, Ont., Canada.

Snader, David L., Professor of Civil Engineering, Stevens Institute of Technology, Hoboken, N. J.

Stebbins, Dean, Instructor in Physics, State College of Washington, Pullman, Wash.

Strong, Everett M., Assistant Professor of Electrical Engineering, Cornell University, Ithaca, N. Y.

Timoshenko, Gregory S., Instructor in Electrical Engineering, Massachusetts Institute of Technology, Cambridge, Mass.

Veit, Robert C., Polytechnic Institute of Brooklyn, Brooklyn, N. Y.

Ware, Lawrence A., Assistant Professor of Electrical Engineering, State University of Iowa, Iowa City, Iowa.

Williams, George K., Instructor in Mechanics, Cornell University, Ithaca, N. Y.

MINUTES OF THE 47TH ANNUAL MEETING OF THE SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION

The 47th annual meeting of the Society for the Promotion of Engineering Education was held at The Pennsylvania State College, State College, Pa., June 19–23, 1939, Karl T. Compton, President, Massachusetts Institute of Technology, President of the Society, presiding. There were 1,610 members and guests registered.

Eighteen conferences were held Monday all day, Tuesday, Wednesday and Thursday afternoons. The programs of these conferences will be found on page .

Monday morning at seven, Council met with the chairmen and secretaries of conferences at breakfast and discussed the work of the committees in charge of conferences. On Monday evening, Council and the ladies of the Council were guests of The Pennsylvania State College at dinner. This was followed by a coffee hour at eight with an informal reception and bridge for the ladies at Atherton Hall.

President and Mrs. R. D. Hetzel gave a reception in Old Main on Tuesday afternoon at four. At eight there was a musical presented by the members of the faculty of The Pennsylvania State College.

Friday morning at a seven o'clock breakfast there was a meeting of the Council and the institutional delegates at which Vice-President M. L. Enger presided.

The first general session was held on Tuesday morning with President Compton in the chair. H. P. Hammond, Dean of the School of Engineering, welcomed the Society to The Pennsylvania State College. President Compton responded. R. D. Hetzel, President, The Pennsylvania State College, addressed the Society on "Social Progress," followed by the presidential address: "Engigeering and Social Progress" by Karl T. Compton, President of the Society. "Trends in Engineering Education" were presented by D. C. Jackson, Emeritus Professor, Massachusetts Institute of Technology. The reports of the Secretary, F. L. Bishop, and the Treasurer, W. O. Wiley, were received and ordered printed.

The second general session was held Wednesday morning with Vice-President G. W. Case in the chair. This session was devoted to Conservation of Natural Resources with the following speakers: "Timber Conservation" by Wilson Compton, Secretary and General Manager, National Lumber Manufacturers Association; "Mineral Resources" by R. J. Lund, Editor, *Mining Congress Journal;*

"Soil Conservation" by C. W. Thornthwaite, Chief, Studies of Climatic and Physiographic Factors of Erosion, U. S. Department of Agriculture; and "Flood Control" by Lt. Col. W. E. Covell, District Engineer, U. S. Engineers Office, Pittsburgh, Pa.

The annual dinner was held Wednesday evening. The Nominating Committee presented the following names. The report was unanimously accepted.

For President: O. J. Ferguson, Professor of Electrical Engineering, and Dean, College of Engineering, University of Nebraska.
For Vice-Presidents:
R. W. Sorensen, Professor of Electrical Engineering, California Institute of Technology;
D. B. Prentice, President, Rose Polytechnic Institute.
For Secretary: F. L. Bishop, University of Pittsburgh.
For Treasurer: W. O. Wiley, John Wiley & Sons, Inc., New York City.
For elective members of Council:
For one year: C. E. MacQuigg, The Ohio State University.
For three years: K. H. Condit, 247 Park Avenue, New York City;
R. C. Ernst, University of Louisville;
V. M. Faires, A. & M. College of Texas;
H. A. Fisher, North Carolina State College;
C. L. Kinsloe, The Pennsylvania State College;
L. G. Straub, University of Minnesota;
B. M. Woods, University of California.

E. B. Roberts, Chairman of the Committee on Lamme Award, presented the report of that committee which named Stephen Timoshenko as the twelfth recipient of this award. In the absence of Professor Timoshenko his colleague, A. B. Domonoske, received the award with the request that he "transmit it to Professor Timoshenko with compliments of the Society and our confident hope and expectation that his distinguished work as a teacher and as an investigator may be continued and that he may be encouraged by this award."

D. S. Kimball, Dean Emeritus, Cornell University, spoke on the development of engineering education and on the part which F. L. Bishop had in that development in the past twenty-five years which he has served the Society as Secretary. President Compton presented Secretary Bishop with an illuminated testimonial "as an indication of the affection and esteem and the gratitude of the members of this Society for the twenty-five years of service."

"To Frederic Lendall Bishop, Ph.D., the Council and members of the Society for the Promotion of Engineering Education

salute and felicitate you on the completion of twenty-five years of service as our Secretary. We commend you for the capable, faithful and unselfish performance of the duties of your office, and we are grateful for the wisdom you have brought to our councils, and for your devotion to the welfare and advancement of our Society. Your long and distinguished service as Secretary, your sound and discriminating judgment as Editor, and your conspicuous achievements as scientist, engineer and teacher have contributed to the improvement of engineering education and to the advancement of engineering. In recognition of your outstanding accomplishments and in token of our sincere affection, we take particular pleasure in presenting to you this testimonial of our respect and gratitude."

Secretary Bishop responded to this tribute and spoke on four topics which he thinks will shape the policy of engineering education in the next ten or twenty years. These topics are the longer engineering course; the need for more research in engineering colleges; more extensive preparation of teachers; and greater emphasis on fundamentals.

The third general session was held on Thursday morning with Vice-President M. L. Enger in the chair. This session was devoted to Engineering Personnel—A Key to Social Progress and was sponsored by the Committee on the Professional Status and Employment of Engineering Graduates. Vice-President Enger turned the meeting over to the chairman of the Committee, J. R. Bangs, who presented the following speakers: B. W. Conrad, Supt. of Schools, Scotia, N. Y., "The High School—The Source of Human Material for Engineering Education"; M. M. Boring, General Electric Co., "A New Source of Material for the Engineering Schools"; R. L. Sackett, Dean-Emeritus, The Pennsylvania State College, discussed these papers; A. R. Cullimore, President, Newark College of Engineering, "Some Basic Factors in Underclass Adjustments"; Melvin J. Evans, Evans Associates, Inc., Chicago, "Attitudes"; discussion by W. E. Hotchkiss, Professor of Social Relations, Carnegie Institute of Technology; J. R. Moynihan, Personnel Advisor, Cornell University, "The Current Situation—A Survey of College Employment Progress for 1939"; Wm. Conover, Assistant Director of Industrial Relations, U. S. Steel of Delaware, discussor.

The fourth and last general session was held Friday morning with President Compton in the chair. The topic of this meeting was The Social Aspects of Engineering. The speakers were R. E. Doherty, President, Carnegie Institute of Technology, "The Social Work of the Engineer"; Isador Lubin, Commissioner of Labor, U. S. Dept. of Labor, "Employment"; W. E. Wickenden, President, Case School of Applied Science, "The Humanistic Band in

the Curriculum." J. T. Shotwell was unable to attend and present his paper on "Social Trends and the Engineer."

The Committee on Resolutions presented the following report which was unanimously adopted by a rising vote.

The Committee on Resolutions of the 47th Annual Meeting, the largest in the history of the Society for the Promotion of Engineering Education, wishes to express the appreciation of the Society and its guests for the numerous courtesies extended by The Pennsylvania State College, its convention committees, and other organizations of the community which have contributed so much toward the success of this meeting.

Therefore be it Resolved:

1. That the Society express appreciation to President and Mrs. R. D. Hetzel for the delightful reception to the members of the Society, and to President Hetzel for his contribution to the annual program.

2. That the gratitude of the Society be extended to Professor C. L. Kinsloe, of the College of Engineering, Chairman of the General Committee, and to all others of The Pennsylvania State College faculty who have so generously devoted time to the plans for our meetings, our entertainment, and the care of the sick.

3. That our thanks be conveyed to the Ladies' Entertainment Committee for their hospitality to the visiting ladies of the Society, and for their thoughtfulness and kindness in the care of the visiting children.

4. That the Society acknowledges with appreciation the addresses delivered at the Annual Dinner by D. S. Kimball, Dean Emeritus, Cornell University, and F. L. Bishop, Secretary of the Society for the Promotion of Engineering Education. Furthermore, that this body go on record as heartily endorsing the action of the Council in recognizing the loyal and devoted service of F. L. Bishop and of the Assistant Secretary, Miss Nell McKenry, to the Society for the Promotion of Engineering Education for the past twenty-five years.

The Committee on Resolutions moves that these resolutions be adopted and that the Secretary of the Society be instructed to send copies to all those who have contributed to the success of the 47th Annual Meeting.

Respectfully submitted,

L. E. CONRAD,
C. S. ELL,
H. J. MCINTYRE,
H. C. SPENCER,
J. L. VAUGHAN, *Chairman.*

The meeting adjourned to meet June 25–28, 1940, at the University of California, Berkeley, Calif.

PROGRAM

1. CHEMICAL ENGINEERING

R. C. KINTNER, Armour Institute of Technology, *Chairman*
J. H. KOFFOLT, Ohio State University, *Vice Chairman*
J. C. WHITWELL, Princeton University, *Secretary-Treasurer*

Tuesday, 2:00 P.M.

Joint Conference with Other Divisions on the Place of Management Courses in the Engineering Curricula. M. C. Molstad, Representative.

Wednesday, 2:00 P.M.

Welcome: F. C. Whitmore and D. S. Cryder, Pennsylvania State College.
Response: R. C. Kintner, Armour Institute of Technology.
Teaching of Thermodynamics. B. F. Dodge, Yale University.
Discussion:
M. R. Fenske, Pennsylvania State College.
W. H. Baskerville, University of Tennessee.
A. H. Cooper, Virginia Polytechnic Institute.
General Discussion.
Kinetics. K. M. Watson, Universal Oil Products Company.
Discussion:
W. L. Faith, Kansas State College.
C. S. Keevil, Bucknell University.
General Discussion.

Thursday.

Luncheon, followed by business meeting. R. C. Kintner, *Chairman*, presiding.

1:30 P.M.

Symposium on The Teaching of Unit Processes. R. N. Shreve, Purdue University, Chairman of Committee on Unit Processes, presiding.
Why Unit Processes.
Remarks by Chairman Shreve.
Training Students for Plant Responsibility. P. H. Groggins, United States Department of Agriculture.
Inorganic Unit Processes. R. C. Kintner, Armour Institute of Technology.
Application of Unit Operation Theory in the Unit Processes of Organic Chemical Production. A. W. Hixon, Columbia University.
What the Teaching of Unit Processes Means to Industry. Jerome Martin, Commercial Solvents Corp.
Subject Matter of a Unit Processes Course. W. L. Faith, Kansas State College.
Fundamentals of Teaching Unit Processes. J. C. Olsen, Polytechnic Institute of Brooklyn.
Unit Processes Laboratory:
R. N. Shreve, Purdue University.
R. K. Toner, Purdue University.

2. CIVIL ENGINEERING

F. T. MAVIS, University of Iowa, *Chairman*

Monday, 9:00 A.M.

General session, F. T. Mavis, presiding.

Report on the Civil Engineering Division, 1938–39.

Report of Committee on Library Facilities. L. E. Grinter, Armour Institute of Technology.

Transportation. Harry Rubey, University of Missouri, presiding.

Tentative Report of Committee IV, S. P. E. E. Civil Engineering Division, Including Summary of Questionnaire.

Summary of Report of the Committee on Education of the American Road Builders Association. M. W. Furr, Kansas State College, *Chairman.*

Summary of Report of Committee on Highway Engineering Education, American Society of Civil Engineers. Julius Adler, Philadelphia, *Chairman.*

The Railway View Point. E. T. Howson, *Railway Age.*

Hydraulics. L. G. Straub, University of Minnesota, presiding.

Study of Requirements for Graduate Work in Hydraulics. Glen N. Cox, Louisiana State University.

Survey of the Methods of Teaching and of the Value of Undergraduate Thesis Work. W. M. Lansford, University of Illinois.

Demonstration-Lecture Method on Teaching Hydraulics. L. G. Straub, University of Minnesota.

Report and Recommendations of Committee on Hydraulics. J. G. Woodburn, University of Wisconsin.

Luncheon Meeting of Executive Committee and Committee Chairman.

1:30 P.M.

Educational Policy and Teaching Methods. H. T. Heald, Armour Institute of Technology, presiding.

Evaluation of the Civil Engineering Product. Symposium:

C. C. Williams, Lehigh University.

E. R. Needles, New York City.

Report of Committee on Educational Policy and Teaching Methods.

3:15 P.M.

Structural Engineering. Frank Kerekes, Iowa State College, presiding.

Undergraduate Course in Reinforced Concrete Design. R. A. Caughey, Iowa State College.

C. E. Sandstedt, A. & M. College of Texas.

Discussion: Hale Sutherland, Lehigh University. J. J. Richey, A. & M. College of Texas.

Place of Photoelasticity in the Teaching of Structural Analysis. Max M. Frocht, Carnegie Institute of Technology.

Discussion: F. L. Plummer, Cleveland, Ohio. A. A. Jakkula, A. & M. College of Texas.

Sanitary Engineering. H. A. Vagtborg, Armour Institute of Technology, presiding.

Sanitary Engineering Curriculum:

E. C. P. D. Accredited Sanitary Engineering Curricula. J. K. Finch, Columbia University.

Training of Public Health Engineers. Langdon Pearse, Chief S. E., Chicago.

Should Short Courses Be Given for the Benefit of Water and Sewage Plant Operators? W. E. Stanley, Cornell University.

What We Expect of the Sanitary Engineer. Samuel Greeley, Greeley & Hansen, Chicago.

6:30 P.M.

Annual Civil Engineering Division Dinner, E. D. Walker, Pennsylvania State College, Chairman.

Informal Entertainment. J. S. Crandell, University of Illinois, Master of Ceremonies.

Tuesday, 12:00 M.

Civil Engineering Division Luncheon.

Report of Nominating Committee and Election of Officers, 1939–40.

2:00 P.M.

Young Men's Forum. H. C. Bird, Duke University, presiding.

Mechanical Service in Engineering Laboratories. G. Brooks Earnest, Case School of Applied Science.

Should Moment Distribution Be Taught to Undergraduates? Stanley H. Fillion, Worcester Polytechnic Institute.

An Instructor Looks at Teaching. Roland H. Trathen, Rensselaer Polytechnic Institute.

Foundations and Soil Mechanics. E. E. Bauer, University of Illinois, presiding.

Theories of Failure of Materials and the Shearing Resistance of Soils; followed by a movie, Engineering Aspects of Soil Behavior. P. C. Rutledge, Purdue University.

Triaxial Compression Test for Cohesionless Soils. John Watson, Harvard University.

Work of the A. S. T. M. Subcommittee on Shearing Resistance. F. J. Converse, California Institute of Technology.

Sanitary Engineering. H. A. Vagtborg, Armour Institute of Technology, presiding.

Sanitary Engineering Laboratory and Its Functions.

Laboratory Facilities and Uses:

C. L. Walker, Cornell University.
L. V. Carpenter, New York University.
G. M. Fair, Harvard University.
P. J. Beard, Stanford University.
H. E. Babbitt, University of Illinois.
H. A. Vagtborg, Armour Institute of Technology.
General Discussion.

Needs for Research in Sanitary Engineering. Wm. Rudolfs, Rutgers University.

Wednesday, 2:00 P.M.

Joint Conference: Committee on Construction Education with Management Division.

3:15 P.M.

Construction Education. M. I. Evinger, University of Nebraska, presiding.

Needs for Research in the Building Industry. J. E. Burchard, Massachusetts Institute of Technology.

Scientific Measurement and Economic Behavior. L. J. Chawner, United States Department of Commerce, Washington, D. C.

The Civil Engineer in Engineering Construction. A. J. Ackerman, Dravo Corporation, Pittsburgh.

Progress Reports of Subcommittees on Construction Education.

Thursday, 2:00 P.M.

Surveying and Geodesy. O. S. Zelner, University of Minnesota, presiding.
History of Surveying. W. H. Rayner, University of Illinois. (Read by Paul P. Rice, Lafayette College.)
The Use of State Coördinate Systems. Philip Kissam, Princeton University.
Discussion: John S. Dodds, Iowa State College.
Plans for Future Programs in Surveying and Geodesy. D. S. Trowbridge, New York University.

3. COMPREHENSIVE EXAMINATIONS

R. L. SACKETT, Hotel White, New York City, *Chairman*

Tuesday, 12:00 M.
Luncheon meeting.
Significance of the E. C. P. D. Coöperative Tests. C. E. Bullinger, Pennsylvania State College.
Comprehensive Examinations for Electrical Engineering Students at The Ohio State University. H. W. Bibber.
Discussion.
Engineering Comprehensive Examination an Aid to the Prediction of Graduation. Wm. H. Formhals and Bradley Stoughton, Lehigh University.
Discussion: C. V. Mann, Missouri School of Mines.

4. COÖPERATIVE ENGINEERING EDUCATION

CECIL A. KAPP, Drexel Institute of Technology, *Chairman*
J. E. MCDANIEL, Georgia School of Technology, *Secretary*

Tuesday, 2:00 P.M.
Cecil A. Kapp, presiding.
Training for Industry. Kenneth A. Meade, General Motors Corporation.
Karl E. Stromsem, National Institute of Public Affairs.
Discussion.
Wednesday, 2:00 P.M.
Cecil A. Kapp, presiding.
Making Most of Coöperative Work Period. Ranald V. Giles, Drexel Institute of Technology.
H. L. Davis, Polytechnic Institute of Brooklyn.
Robert Widdop, Newark College of Engineering.
Discussion.

5. ELECTRICAL ENGINEERING

CARLTON E. TUCKER, Massachusetts Institute of Technology, *Chairman*

Monday, 9:00 A.M.
Electrical Engineering Laboratory. Carlton E. Tucker, presiding.
Order of Events. E. C. Woodruff, Pennsylvania State College.
Safe Practices in College Laboratories. M. S. Coover, Iowa State College.
Electrical Engineering Courses for Mechanical Engineering Students. L. E. Beck, Purdue University.

1:30 P.M.

Design in Electrical Engineering Instruction. Carlton E. Tucker, presiding.

Practice of Teaching Electrical Design. T. C. Lloyd, Robbins & Myers.

Design and Construction of Experimental Vacuum Tubes in Engineering School Laboratories. T. S. Gray, Massachusetts Institute of Technology.

6:30 P.M. Annual Dinner.

Correction of Difficulties in Speech. C. R. Stother, University of Washington.

6. ENGINEERING DRAWING

CARL L. SVENSEN, Lubbock, Texas, *Chairman*
H. C. SPENCER, A. & M. College of Texas, *Secretary*

Monday, 9:00 A.M.

Carl L. Svensen, presiding.

Progress in the Teaching of Descriptive Geometry, C. E. Rowe, University of Texas.

Discussion: W. H. Farnham, Tufts College. G. J. Hood, University of Kansas.

Secondary School Mechanical Drawing as Viewed by Engineering College.

Teachers. S. J. Berard, Brown University.

Discussion: R. P. Hoelscher, University of Illinois. E. F. Tozer, Northeastern University.

Teaching Freehand Lettering to Engineering Freshmen. W. D. Turnbull, Ohio State University.

Discussion: T. E. French, Ohio State University.

Tuesday, 6:30 P.M.

Dinner Meeting. Carl L. Svensen, presiding.

Address. H. E. Degler, University of Texas.

Report of the Judges of Divisional Drawing Competition.

Wednesday, 12:10 P.M.

Luncheon Meeting. Thos. E. French, presiding.

Effect of the Tendency of Administrators to Reduce the Time or Shorten Courses in Drawing. A. S. Levens, University of Minnesota. General Discussion.

2:00 P.M.

Clair V. Mann, presiding.

Necessity for and Application of Engineering Drawing Equipment. N. D. Thomas, Ohio University.

Discussion: J. M. Miller, Rice Institute. C. E. Rowe, University of Texas. Justus Rising, Purdue University.

Dimensioning Round Table, led by W. E. Street, Texas Technological College.

Discussion: R. T. Northrup, Wayne University. H. C. Hesse, University of Virginia.

Teaching Freehand Sketching to Engineering Freshmen. A. E. Ziprich, Mechanics Institute.

Method of Reading Before Writing the Graphic Language. F. W. Walsh, Milwaukee, Wis.

REPORTS:
Visualization, C. V. Mann.
Publications, C. V. Mann.
Graphic Talents Test, H. C. Hesse.
Historical Book, F. M. Porter.
Drawing Instruments, H. M. McCully.
T-Square Page, F. M. Porter.
Historical Drawings, W. G. Smith.
Shingles, O. A. Olson.
Historical Instruments, F. W. Ming.
Curriculum, S. J. Berard.
Other Committees.
Nomination Committee.
Election of Officers.
Business Meeting of Executive Committee.

7. ENGINEERING ECONOMY

EUGENE L. GRANT, Stanford University, *Chairman*
ANDREW I. PETERSON, New York University, *Secretary*

Thursday, 7:00 P.M.
Eugene L. Grant, presiding.
Conflicting Views on a Definition for Engineering Economy. Edmund D. Ayres, University of Wisconsin.
Panel Discussion. B. M. Woods, University of California, presiding.
Teaching Methods for the Course in Engineering Economy.
J. C. Clark, University of Arizona.
J. K. Finch, Columbia University.
R. C. Putnam, Case School of Applied Science.
J. C. G. Seidl, Manhattan College.

8. ENGINEERING RESEARCH

F. T. MAVIS, University of Iowa, *Chairman*

Wednesday, 3:15 P.M.
F. T. Mavis, presiding.
Popularizing Research. Watson Davis, Science Service, Washington, D. C.
Round Table—Committee on Engineering Research and its Functions.
Working Committee.
Clearing Committee.
Steering Committee.

9. ENGLISH

E. C. ELLIOTT, Purdue University, *Chairman*
H. L. CREEK, Purdue University, *in Charge of Program*
W. R. DUMBLE, Ohio State University, *Secretary*

Monday, 1:30 P.M.
H. L. Creek, presiding.
Where Do Correct Language Habits Reside? Alfred Westfall, Colorado State College.
Problem of the Poorly Prepared Student. A. M. Fountain, North Carolina State College.
Instruction in Speech in Engineering Colleges. Donald Hayworth, Michigan State College.

Some Experiments in the Teaching of Literature. J. L. Vaughan, University of Virginia.

Tuesday, 2:00 P.M.

K. O. Thompson, Case School of Applied Science, presiding.

English Must Advertise—and How. John Mills, Bell Telephone Labs.

Thirty Years of Teaching Technical English to Engineers. W. O. Sypherd, University of Delaware.

6:30. Dinner.

Sada A. Harbarger, Ohio State University, presiding.

Relation Between High School English and College English as a Basis of Work in Engineering. T. J. Gates, Pennsylvania State College.

Basal Reading Tests for Engineering Students. E. A. Betts, Pennsylvania State College.

Literature and the Engineer. W. S. Dye, Pennsylvania State College.

10. INDUSTRIAL ENGINEERING

C. E. Bullinger, Pennsylvania State College, *Chairman*

Monday, 1:30 P.M.

L .P. Alford, New York University, presiding.

Conference on Cost Control, Personnel and Industrial Relations.

Methods for Teaching Cost Control. E. L. Grant, Stanford University.

Methods of Teaching Personnel and Industrial Relations. C. W. Beese, Purdue University.

Tuesday, 2:00 P.M.

Asa S. Knowles, Northeastern University, presiding.

Joint Conference with Groups from Civil, Electrical, Chemical, Industrial Engineering, and Mineral Technology Curricula.

Place of Management Training in Engineering Curricula.

What the Engineer Needs to Know About Management. Howard M. Hubbard, Harris-Seybold Potter Co., Cleveland, Ohio.

Training Engineers to Handle Men. Myron H. Clark, Boston, Mass.

6:30. Dinner meeting for those interested in the teaching of management to engineers, C. E. Bullinger, presiding.

Subject: Thirtieth Anniversary of the Industrial Engineering Curriculum.

Toastmaster: R. L. Sackett, Dean Emeritus, Pennsylvania State College.

Hugo Diemer—An Appreciation. J. O. Keller, Pennsylvania State College.

Development of the Teaching of Management to Engineers. C. W. Lytle, New York University.

Development of Industrial Engineering and Engineering Management in Industry. S. M. Lowry, Proctor & Gamble Co., Cincinnati, Ohio.

What Is Ahead in Engineering Management and Its Teaching. D. S. Kimball, Cornell University.

Wednesday, 2:00 P.M.

J. R. Bangs, Cornell University, presiding.

Industrial Engineering Curriculum:

Preliminary Report on Nomenclatures with Respect to Industrial Engineering and Related Courses. C. W. Lytle, New York University.
Discussion: Asa S. Knowles, Northeastern University.

Development of the New Administrative Engineering Curriculum at New York University. L. P. Alford, New York University.
Discussion: G. R. Hanselman, Cornell University.

Industry Evaluates the Industrial Engineering Curriculum. G. A. Maney, Northwestern University.

Discussion: C. E. Davies, American Society of Mechanical Engineers.

Thursday, 2:00 P.M.

H. G. Thuesen, Oklahoma A. & M. College, presiding.

Industrial Engineering Methods, Time and Motion Study, Factory Planning, Tool Engineering:

Methods Work of the Industrial Engineers. J. A. Hagan, Carnegie-Illinois Steel Corp., Pittsburgh.

Methods of Teaching Motion and Time Study at New York University. D. B. Porter, New York University.

Methods of Teaching Jig and Fixture Design and the Application of Gaging in Interchangeable Manufacture. Carlos deZafra, New York University.

Informal discussion of a survey on the content, objectives and teaching methods of Methods Courses.

11. INSTRUCTIONAL METHODS

CARL S. ELL, Northeastern University, *Chairman*

A. L. TOWNSEND, Massachusetts Institute of Technology, *Secretary*

Tuesday, 12:00 M.

R. W. Morton, University of Tennessee, presiding.

Use of Motion Pictures in Engineering Education. George E. Tomlinson, T. V. A.

Discussion: H. J. Gilkey, Iowa State College. R. L. Spencer, University of Delaware.

Thursday, 2:00 P.M.

C. S. Ell, presiding.

Teaching Technics in Strength of Materials.

Interdependence of Teaching Loads and Teaching Methods. Wm. C. White, Northeastern University.

Imparting Knowledge vs. Developing Skills. Wm. L. DeBaufre, University of Nebraska.

Correlation of Classroom and Laboratory Instruction. Geo. P. Boomsliter, West Virginia University.

Photoelastic Demonstrations as Teaching Aids. Max M. Frocht, Carnegie Institute of Technology.

Discussion.

12. JUNIOR COLLEGES

W. E. WICKENDEN, Case School of Applied Science, *Chairman*

Wednesday, 12:00 M. Luncheon meeting.

13. MATHEMATICS

ALAN HAZELTINE, Stevens Institute of Technology, *Chairman*

J. H. WEAVER, Ohio State University, *Secretary*

Tuesday, 2:00 P.M.

Joint Conference with Mechanics.

(*a*) Mathematical Difficulties Encountered by Students in Elementary Mechanics. Glen N. Cox, Louisiana State University.

(*b*) Topics and Courses in Mathematics Which Are Desirable Prerequisites for Advanced Courses in Mechanics. N. C. Riggs, Carnegie Institute of Technology.

What Changes in Existing Mathematics Courses Would Be Necessary to Meet the Needs Outlined in Topics (*a*) and (*b*)? Tomlinson Fort, Lehigh University.

Thursday, 2:00 P.M.

Chairman's Address: Basic Physics as a Part of Mathematics. Alan Hazeltine, Stevens Institute of Technology.

A Professor in an Arts College Views Mathematics Courses for Engineering Students. F. Jonah, Western Reserve University.

Report of Committee on the Collection of Engineering Problems for Use in Mathematics Courses. John W. Cell, North Carolina State College, Chairman.

6:30 P.M. Dinner Meeting, Alan Hazeltine, presiding.

Business Meeting.

Election of Officers.

14. MECHANICS

H. J. GILKEY, Iowa State College, *Chairman*
GLENN MURPHY, Iowa State College, *Secretary*

Monday, 9:00 A.M. H. J. Gilkey, presiding.

How to Broaden the Engineer's Education by Teaching the Historical Background. R. H. Carey, Pennsylvania State College.

An Experiment in Teaching Methods for the Course in Materials Laboratory. C. J. Posey, University of Iowa.

Forum Discussion: Final Examination in Relation to Such a Course as That in Materials Testing.

1:30 P.M. Edgar MacNaughton, Chairman Machine Design, presiding.

Joint Meeting with Machine Design. ....

Development of New Products. A. R. Stevenson, General Electric Co.

Forum: Function of Mechanics with Respect to Machine Design.

Leader: F. L. Eidmann, Columbia University.

Discussors: A. W. Luce, Lehigh University. D. H. Pletta, Virginia Polytechnic Institute. E. S. Ault, Purdue University.

Tuesday, 2:00 P.M.

Alan Hazeltine, Chairman Division of Mathematics, presiding.

Joint Meeting with Mathematics Division.

Forum on Interrelations of Mathematics and Mechanics:

(*a*) Mathematical Difficulties Encountered by Students in Elementary Mechanics. Glen N. Cox, Louisiana State University.

(*b*) Topics and Courses in Mathematics Which Are Desirable Prerequisites for Advanced Courses in Mechanics. N. C. Riggs, Carnegie Institute of Technology.

What Changes in Existing Mathematics Courses Would Be Necessary to Meet the Needs Outlined in Topics (*a*) and (*b*)? Tomlinson Fort, Lehigh University.

6:30 P.M. Annual Dinner, H. J. Gilkey, presiding.

Place of Mechanics in Our Expanding Industries. S. C. Hollister, Cornell University.

Election of two new members to Executive Committee.

15. MECHANICAL ENGINEERING

JILES W. HANEY, University of Nebraska, *Chairman*
C. H. CASBERG, University of Illinois, *Secretary*

Monday, 10:00 A.M.

Paul Eaton, Lafayette College, presiding.

Machine Design Group:

Teaching of Lubrication and Bearing Design. Louis J. Bradford, Pennsylvania State College.

1:30 P.M. Edgar MacNaughton, Tufts College, presiding.

Joint Session of Engineering Mechanics Division and Machine Design Group.

Development of New Products. A. R. Stevenson, Jr., General Electric Co.

Tuesday, 12:00 M.

Luncheon.

Reunion of those who attended the summer school for mechanical engineering at Purdue University in 1929. Everybody invited. Program light and reminiscent.

2:00 P.M. Jiles W. Haney, presiding.

General Session of the Division.

Business meeting.

Program sponsored by the Heat-Power Group, Ben G. Elliott, University of Wisconsin, Leader.

Survey of Heat-Power Engineering Courses in the United States.

Program sponsored by the Mechanical Laboratory Group, G. L. Tuve, Case School of Applied Science, Leader.

Correlation of Class Room and Laboratory Work in the Heat-Power Field.

Discussion: H. W. Blackburn, Syracuse University. J. B. Jones, Virginia Polytechnic Institute. R. B. Kolb, Worcester Polytechnic Institute. P. E. Mohn, University of Illinois.

6:30 P.M. Annual Dinner, Jiles W. Haney, presiding.

Study of Gears. Illustrated with motion pictures. David L. Arm, Purdue University.

Presentation of newly elected officers of the Division for 1939–40.

Wednesday, 2:00 P.M.

Jiles W. Haney, presiding.

General Session of the Division.

Business meeting.

Program sponsored by the Manufacturing Processes Group, R. L. Sweigert, Georgia School of Technology, Leader.

Do Instructional Methods Used in Manufacturing Process Laboratories Contribute to Trade Training or to Engineering Education?

Round Table Discussion:

C. W. Crawford, A. & M. College of Texas.
O. W. Boston, University of Michigan.
L. J. Lassalle, Louisiana State University.
M. M. Boring, General Electric Co.
B. M. Woods, University of California.
C. H. Casberg, University of Illinois.
M. P. Cleghorn, Iowa State College.
L. G. Miller, Michigan State College.

C. W. Ham, University of Illinois.
F. L. Eidmann, Columbia University.
A. L. Townsend, Massachusetts Institute of Technology.
E. MacNaughton, Tufts College.

16. MINERAL TECHNOLOGY

BRADLEY STOUGHTON, Lehigh University, *Chairman*

Monday, 1:30 P.M.

Richard S. McCaffery, University of Wisconsin, presiding.

Round Table Discussion:

Undergraduate Laboratory Courses in Metallurgy.

Wednesday, 2:00 P.M.

Fundamental Science vs. Empiricism in Mineral Dressing Instruction. A. W. Fahrenwald, University of Idaho.

Proposed Curriculum for the Course of Study Leading to the Degree of B.S. in Mineral Technology. Kenneth H. Donaldson, Case School of Applied Science.

The Desirability and Usefulness of the Establishment of Separate Curricula in the Dressing of Minerals. P. C. Emrath, University of Kentucky.

Report on graduates and acquaintances in active directing technical control of mineral dressing operations, as to their formal educational training and its deficiencies, if any, as preparation for their present job. N. H. Manderfield, Michigan College of M. & T.

A proposal for departmental reorganizations in light of present financial conditions at engineering schools. Arthur F. Taggart, Columbia University.

Thursday, 2:00 P.M.

Richard S. McCaffery, University of Wisconsin, presiding.

Round Table Discussion:

Graduate Work in Metallurgy.

17. ORIENTATION OF FRESHMEN

ALLAN R. CULLIMORE, Newark College of Engineering, *Chairman*

Wednesday, 2:00 P.M.

A. R. Cullimore, presiding.

Some Freshmen Problems. A. R. Cullimore, Newark College of Engineering.

Factors—Other Than Intellectual—in the Education of Engineers. Joseph E. Raycroft, Dept. of Institutions and Agencies, Trenton, N. J.

Some Experiences with Reading Clinics. Emmett A. Betts, Pennsylvania State College.

18. PHYSICS

G. E. GRANTHAM, Cornell University, *Chairman*

Monday, 1:30 P.M.

G. R. Grantham, presiding.

Intermediate Physics for Engineering Students. C. E. Bennett, University of Maine.

Naval Academy Instruction Methods. Earl W. Thomson, U. S. Naval Academy.

Thursday, 2:00 P.M.

G. E. Grantham, presiding.

Physics and the Engineering Student. S. C. Hollister, Cornell University.

Physics at Penn State. D. C. Duncan, Pennsylvania State College.

LOCAL COMMITTEES

Central

C. L. Kinsloe, *Chairman*, L. A. Doggett, *Secretary*, R. U. Blasingame, F. L. Carnahan, J. O. Keller, H. Landsberg.

Meetings and Conferences

E. D. Walker, *Chairman*, C. V. D. Bissey, R. V. Watkins, L. S. Rhodes, A. P. Powell, M. M. Stephens, E. W. Schroeder, C. A. Eder.

Council Meetings

R. E. Minshall, *Chairman*, C. S. Holt, J. W. Breneman, F. A. Tebo.

Transportation

P. X. Rice, *Chairman*, H. C. Roundtree, R. D. Fellows, R. R. Cleland, J. R. Haswell, G. L. Crossley, N. R. Sparks.

Information

B. K. Johnstone, *Chairman*, H. G. Pyle, J. O. P. Hummel, J. S. Doolittle, E. K. Hibshman, D. A. Campbell, T. S. Patterson, A. W. Case.

Publicity

J. E. Kaulfuss, *Chairman*, L. H. Bell, J. B. Helme, W. F. Dantzscher.

Service to Guests

G. D. Thomas, *Chairman*, C. A. Lamm, I. C. Boerlin, G. L. Guillet, Miss R. E. Graham, Miss A. M. Chubb.

Care of Children

Mrs. L. A. Doggett, *Chairman*, Mrs. M. S. McDowell, Mrs. L. A. Richardson, Mrs. A. L. Tobias, Mrs. J. H. Simmons, Mrs. H. B. Norris, Mrs. A. E. Neyhart, Mrs. R. R. Bloom, Mrs. M. S. Gjesdahl.

Housing

C. E. Bullinger, *Chairman*, E. R. Queer, M. M. Babcock, J. E. Nicholas, H. W. Loman, Miss M. L. Willard, E. B. Cassel, A. L. Tobias, J. T. Larkins, P. W. Knepp, P. D. Wright, P. R. Hall, Mrs. E. F. Richardson.

Trips

F. G. Hechler, *Chairman*, F. R. Smith, D. C. Jones, W. P. Davey, F. M. Torrence, W. R. White, H. L. Yeagley, G. R. Green, V. A. Beede, A. H. Forbes, R. K. Bernhard.

Registration

E. L. Keller, *Chairman*, B. V. Moore, W. R. Young, L. A. Richardson, C. E. Govier, D. C. Sprague, P. J. Reber, R. R. Bloom, J. E. Crouch, J. J. Uicker, A. H. Zerban, J. J. Light, C. G. Vandergrift, J. M. Holme, M. S. Gjesdahl, C. L. Allen.

Recreation

E. C. Davis, *Chairman*, C. C. Wright, Miss Marie Haidt, F. C. Stewart, C. L. Harris, R. E. Galbraith, K. J. DeJuhasz, Miss Arbuckle, L. J. Bradford, H. R. Thayer.

Banquet and Group Dinners

E. B. Stavely, *Chairman*, M. T. Bunnell, Miss Helen Savard, M. R. Cannon, H. I. Tarpley, L. S. Rhodes.

President's Reception

A. O. Morse, *Chairman*, W. E. Kenworthy, F. W. Owens, Miss R. E. Graham H. A. Everett, D. F. McFarland, A. W. Clyde, P. H. Schweitzer, P. P. Henshall, H. E. Dickson.

Entertainment

R. A. Hussey, *Chairman*, J. E. Kennedy, M. W. White, E. Teichert, F. Owens, H. Fishburn, G. D. Thomas, H. I. Tarpley.

Ladies Committee

Hostesses

Mrs. R. D. Hetzel, *Chairman*, Mrs. H. P. Hammond, Mrs. E. Steidle, Mrs. A. O. Morse, Mrs. F. C. Whitmore, Mrs. S. W. Fletcher, Mrs. J. O. Keller, Mrs. S. K. Hostetter.

General Committee

Mrs. F. H. Hechler, *Chairman*, Mrs. H. P. Hammond, *Vice Chairman*, Mrs. E. D. Walker, Mrs. H. A. Everett, Mrs. C. E. Bullinger, Mrs. E. C. Woodruff, Mrs. R. K. Bernhard, Mrs. E. L. Keller, Mrs. B. K. Johnstone, Mrs. F. W. Owens.

Reception

Mrs. F. W. Owens, *Chairman*, Mrs. H. A. Everett, Mrs. L. J. Bradford, Mrs. M. M. Babcock, Mrs. C. E. Govier, Mrs. G. D. Thomas, Mrs. J. E. Kaulfuss, Mrs. J. E. Crouch, Mrs. G. L. Guillet, Mrs. N. R. Sparks, Mrs. L. S. Rhodes, Mrs. R. A. Hussey.

Entertainment

Mrs. E. B. Stavely, *Chairman*, Mrs. H. I. Tarpley, Mrs. A. H. Forbes, Mrs. C. E. Bullinger, Mrs. F. C. Stewart, Mrs. E. D. Walker, Mrs. J. W. Breneman, Mrs. G. L. Crossley, Mrs. P. B. Kapp, Mrs. H. E. Dickson, Mrs. P. D. Wright, Mrs. C. B. Holt, Mrs. F. A. Tebo, Mrs. D. B. Kennedy, Mrs. J. S. Leister, Mrs. J. M. Bolton, Mrs. E. L. Keller, Mrs. E. R. Queer, Mrs. K. J. Dejuhasz, Mrs. C. A. Anderson, Mrs. R. W. Henninger, Mrs. J. M. Holme, Mrs. P. W. Knepp.

Trip and Transportation

Mrs. F. M. Torrence, *Chairman*, Mrs. R. B. Day, Mrs. W. G. Thompson, Mrs. R. O'Donnell, Mrs. E. M. Broderick, Mrs. H. R. Thayer, Mrs. C. A. Eder, Mrs. J. S. Doolittle, Mrs. C. G. Vandergrift, Mrs. A. H. Zerban, Mrs. R. D. Scheirer, Mrs. T. S. Patterson, Mrs. R. E. Minshall, Mrs. G. H. Resides, Mrs. H. A. Sorensen, Mrs. D. L. Markle, Mrs. I. C. Boerlin, Mrs. J. T. Larkins.

Flowers or Decoration

Mrs. P. X. Rice, *Chairman*, Mrs. P. H. Schweitzer, Mrs. C. L. Harris, Mrs. R. K. Bernhard, Mrs. A. P. Powell, Mrs. E. Axman, Mrs. K. J. Heidrich, Mrs. P. P. Henshall, Mrs. J. O. P. Hummel, Mrs. J. J. Uicker, Mrs. P. R. Hall.

Recreation

Mrs. H. K. Kistler, *Chairman*, Mrs. B. K. Johnstone, Mrs. D. A. Campbell, Mrs. E. C. Davis, Mrs. P. J. Reber, Mrs. A. W. Case, Mrs. E. D. Grimison, Mrs. E. L. Whitaker, Mrs. R. R. Bloom.

REPORT OF THE TREASURER, W. O. WILEY

Statement of Cash Account, June 15, 1939

Balance on Hand—June 20, 1938:		
Forbes National Bank—Checking Account	$ 4,754.46	
Forbes National Bank—Savings Account	7,511.79	$12,266.25
Receipts:		
Current Dues	$12,938.10	
Back Dues	1,105.75	
Dues in Advance	198.50	
Sales of Publications	482.32	
Advertising	2,138.09	
Sales of Emblems	74.75	
Interest on Savings Account	176.24	$17,113.75
Total		$29,380.00
Disbursements:		
Cost of Publications	$ 6,879.98	
Cost of Proceedings	273.45	
Honorarium for Secretary	2,000.00	
Salaries—Secretary's Office	3,999.97	
Travel and Entertainment—Secretary's Office	303.90	
Committee Expense	491.90	
Printing, Postage, Office Supplies, etc.	864.29	
Sectional Dues	402.50	
Expenses—1938 Meeting	519.79	
Expenses—1939 Meeting	610.08	
Dues—American Council on Education	100.00	
Dues—American Engineering Council	250.00	
Advance for Lamme Award Medal	175.49	$16,871.35
Balance on Hand—June 15, 1939:		
Forbes National Bank—Checking Account	$ 4,820.62	
Forbes National Bank—Savings Account	7,688.03	$12,508.65

Income and Expense Statement

for the Year Ending June 15, 1939

Expense

Cost of Publications	$ 7,679.98
Cost of *Proceedings*	273.45
Expenses—1938 Meeting	983.66
Honorarium for Secretary	2,000.00
Salaries—Secretary's Office	3,999.97
Printing, Postage, Office Supplies, etc.	864.29
Travel and Entertainment—Secretary's Office	303.90
Committee Expenses	491.90
Dues—American Council on Education	100.00
Dues—American Engineering Council	250.00
Sectional Dues	402.50
	$17,349.65

Income

Current Dues	$13,894.60
Back Dues	405.75
Sales of Publications	482.32
Advertising	2,054.09
Sales of Emblems	74.75
Interest on Savings Account	176.24
	$17,087.75
Deficit for the year	261.90
	$17,349.65

Balance Sheet, June 15, 1939

Assets

Cash:		
Current Fund	$4,820.62	
Petty Cash Fund	300.00	
Life Membership Fund	833.12	
Benj. G. Lamme Fund	155.13	$ 6,108.87
Savings Account:		
Forbes National Bank—No. 3809		7,688.03
Benj. G. Lamme Trust Fund:		
Securities and Mortgages	$5,019.44	
Uninvested Cash	22.31	
Gross Income with Trustee	78.50	5,120.25
Prepaid Expenses—1939 Meeting		610.08
Inventory		1.00
Accounts Receivable:		
Advertising	$ 500.00	
Dues	700.00	
Benj. G. Lamme Fund:		
1938 Award	175.49	
1939 Award	175.49	1,550.98
Furniture and Equipment (est.)		100.00
		$21,179.21

Liabilities

Life Membership Fund		$ 833.12
Benj. G. Lamme Fund		5,275.38
Prepaid Membership Dues		198.50
Accounts Payable—June Journal		800.00
Surplus Account:		
Balance at June 20, 1938	$14,334.11	
Deficit for present year	261.90	14,072.21
		$21,179.21

REPORT OF THE SECRETARY, 1938–39

By F. L. BISHOP

The Secretary presents herewith a brief summary of the activities of the Society for 1938–39:

Council.—The Council is the policy forming body of the Society. Several meetings are held at the time of the annual meeting at which time the policies of the Society for the ensuing year are thoroughly discussed and acted upon by the Council. With the Council meeting only once a year, it is important for the best interests of the Society that a large number of the members attend. You may be interested in knowing that Council consists of 49 members; of these 10 are inactive and unable to attend meetings because of their health. Of the 39 remaining, 32, or about 82 per cent, will be in attendance at this meeting. Twenty-seven attended the meeting last year in Texas, and 33 the M. I. T. meeting. This means that we have a representative body actively engaged in determining the policies of the Society. The policy for the ensuing year having been laid down by the Council, it becomes the duty of the Executive Committee to carry it out. I shall later bring to the attention of the Council the question as to how it may serve more effectively in the affairs of the Society.

Membership.—The total membership is 3,089; 2,945 individual and 144 institutional members. The Council elected 259 individual and 5 institutional members during the year.

We have lost 110 members—21 by death: H. B. Alvord, W. E. Barlow, G. C. Bauer, D. E. Carpenter, Hugo Diemer, F. W. Durkee, Ralph Earle, J. O. Hamilton, J. D. Hoffman, C. S. Howe, W. H. Kavanaugh, M. A. Lee, Lloyd Logan, A. Mailhoit, G. I. Mitchell, Allen Rogers, W. T. Ryan, Herman Schneider, E. H. Wells, E. A. Wheatley, W. E. Wilbur—24 were dropped for non-payment of dues, and 65 resigned.

Publications.—Ten issues of the JOURNAL were issued as usual during the year. With the assistance of H. J. Gilkey, the year book was remodeled making the occupational and the geographical distribution of membership of more value to the members.

We also issued a supplement to the JOURNAL which contained a list of the accredited engineering curricula in the United States.

Sections and Branches—G. W. Case, Chairman of Sections and Branches, will report in detail on the activities of this group. It is sufficient for the Secretary to say that the meetings of sections have

been exceptionally well attended and the programs have in every case been of high quality. The attendance at some of these meetings is larger than the total attendance at the annual meetings only a few years ago.

The Treasurer's report will show that the sections received from the Society a total of $402.50. One section, the Kansas-Nebraska, refused to accept such payment and refunded the money to the members paying the additional $.50 to the Society.

Survey of English.—The Committee on English, under the chairmanship of E. C. Elliott and H. L. Creek of Purdue University, has been making a survey of the teaching of English to engineering students under a grant from the Carnegie Foundation. This survey is progressing very satisfactorily and the results are being published in the JOURNAL under English Notes each month. It is encouraging to hear a remark like the following: At a meeting of the Committee held in Pittsburgh recently, one professor of English of a large university dealing with all kinds of students stated that this Society had made more progress in the teaching of freshman English than any other organization.

Summer School for Chemical Engineers.—Attention should be called to the summer school for chemical engineers which is being held here at State College immediately following the adjournment of this meeting. An excellent program has been prepared and judging from the amount of correspondence passing through the Secretary's office concerning it, we know it is creating a large amount of interest and will have a large attendance.

Summer Conference on Engineering Education.—A conference is being held at the University of New Hampshire this summer, the program for which also appears in the program of this meeting and should prove attractive and valuable for those who attend.

Regional Conferences.—Under Committee No. 8, Civil Engineering Division, there have been held a series of regional conferences. Three of these have been held, one at Louisville, Iowa and Missouri, the latter early in April. Another conference is being held at Case School of Applied Science.

Divisions.—The above illustrates that the divisions are active and energetic organizations which do not confine themselves to the annual meetings but are at work throughout the year. They are undoubtedly creating a large amount of interest among the younger members of the teaching staff.

Engineer's Council for Professional Development.—The Committee on Engineering Schools, under the chairmanship of K. T. Compton, issued a new list of accredited curricula last fall. This was reprinted by the Society as a supplement and distributed to all members and to a large number of requests.

The Committee on Professional Recognition in which the Society should be particularly interested is holding a meeting at State College this week.

Employment Service.—The employment service this year had many more vacancies than it was possible to fill. The reason for this was that many requests were received for graduate assistants or instructors and our membership is composed of men already teaching who are interested in advancing their positions. This service is given to all institutions and to members of the Society without any charge.

Institutional Division.—The question of how much time should be given to the meeting of the institutional delegates should be considered by the Council. It would seem that a breakfast meeting does not offer sufficient time.

CIVIL ENGINEERING PAGE

M. W. FURR, *Chairman*
F. T. MAVIS, *Past Chairman*
PAUL P. RICE, *Secretary*
E. E. BAUER, *Editor*
L. G. STRAUB
F. W. STUBBS, JR.
H. T. HEALD

REPORT OF ANNUAL MEETING, STATE COLLEGE, PENNSYLVANIA

BY M. W. FURR, Retiring Editor

The meetings and conferences of the Civil Engineering Division of the forty-seventh annual meeting of the Society each were interesting and pleasurable events. A written report of all activities would be too voluminous for this space. An early issue of the JOURNAL will carry a more comprehensive report of the meeting and detailed reviews of the papers presented will be covered in so far as possible by Editor Bauer and published in Volume 5 of the *Civil Engineering Bulletin* or through this medium as the *Civil Engineering Page*.

It is difficult for the writer to enumerate the highlights of the meeting—the general Divisional meetings and committee conferences each were equally meritorious. The Division's eight committees were superlatively active and all programs were acclaimed to be very satisfactory. The 1939 Executive Committee wishes to thank each and every person having a part in the convention. The Committee wants to recognize and state that it gratefully appreciates the work of the Local Committee of the Pennsylvania State College staff in making the program a delightful affair. Also, and before closing our felicitous remarks, the civil engineering group wishes to praise the untiring efforts of Chairman F. T. Mavis put forth the past year. A job well done.

Special professional conferences held the past year were as follows: Second Regional Surveying Teachers' Conference, 1938, Louisville; Third Regional Surveying Teachers' Conference, 1939, Missouri School of Mines; and the S. P. E. E. Hydraulic Conference, 1939, University of Iowa. These meetings were held under the auspices of Committees VIII and V, respectively, of the Civil Engineering Division. Year-by-year an increasing interest is manifested in the work of the committees of the Division and in conference programs.

More information should be at hand soon on the recently completed Fourth Regional Surveying Teachers' Conference held at Georgia School of Technology. In looking forward from this date plans are already beyond the tentative stage for a Second National Surveying Teachers' Conference to be held some time during the mid-summer period of the year 1940 at the Surveying Camp of the Case School of Applied Science. It was suggested and agreed by some of the members of Committee IV that it should sponsor a Conference on Transportation, providing the Division can see fit to authorize a meeting for that purpose.

The following officers were elected at the Luncheon meeting at Pennsylvania State College Tuesday noon. The personnel of the Executive Committee for the ensuing year is: Professor M. W. Furr, Kansas State College, *Chairman;* Professor Paul P. Rice, Lafayette College, *Secretary;* Professor E. E. Bauer, University of Illinois, *Editor;* Directors—Professors L. G. Straub, University of Minnesota, F. W. Stubbs, Jr., Rhode Island State College, and President H. T. Heald, Armour Institute of Technology. Professors Bauer and Straub are new members of the Executive Committee. Retiring members of the Committee are Professors F. T. Mavis, Pennsylvania State College, and Hale Sutherland, Lehigh University.

ENGINEERING ECONOMY PAGE

EDMUND D. AYRES, University of Wisconsin, *Editor*

UNAMORTIZED VALUES IN REPLACEMENT STUDIES

Is not the replacement problem being complicated by a number of issues which are matters of policy rather than result? Unamortized values arise through honest inability to establish correct depreciation rates. Nevertheless, provision must be made for paying for these errors. The question is, how is repayment to be made and upon what basis should the replacement study be conducted? Perhaps the last portion of the question should come first.

It seems only reasonable that replacement studies should be done in a manner that is consistent with accepted and understood business practice so that management may readily obtain the answers to the questions they will normally ask before making any decision. Those who have had experience with this matter in industry know that the first two questions asked in the majority of cases are: (1) What will be the return on the required investment under the assumed conditions? and (2) How long will it take for the equipment to pay for itself so that no loss will be incurred in case conditions change? In fact, in many instances the latter question is asked first. It therefore seems that the facts call for the study to answer these questions.

For similar reasons there is no justification for interest on the investment to appear as an item of annual cost unless capital is actually borrowed. Business gave up this idea long ago. It cannot be allowed in the accounting which must follow investment, so why should it be introduced into the replacement study? In short, since the engineer is one member of the business organization, why shouldn't he abide by the rules which govern the others? Is not the violation of this principle one of the main reasons why the engineer has, in many companies, been held to have no knowledge of business management and is not entrusted with it? Correct interpretation of several of the methods will give correct results, but complex interpretation should not be necessary. Management clearly understands the meaning of "rate of return on the investment." It will usually base its decision on this factor.

Capital losses arising through replacement of unamortized equipment must be absorbed. Each company must decide how this is to be done. It may be accomplished by requiring the replacing machine to write off the unamortized value or by charging the loss to a surplus account maintained for this purpose. The latter practice is used by a considerable number of large companies and is undoubtedly coming into more general favor. In smaller companies, and where no such account is maintained, the only practicable method seems to be to require the replacing equipment to write off the loss. If one method is used there is no need to include unamortized values in the replacement study as recognizable items. However, they are included but well disguised. If the other method is used this item must be recognized in order to prevent depletion of capital.

The fact that correct use of the two methods will yield almost identical results does not seem to be realized by many. If unamortized values are charged to a surplus account each piece of equipment must earn two profits to justify investment in it. These are: (*a*) normal profit on the invested capital (return to the owners), and (*b*) additional profit to provide a surplus for adjusting capital losses. The total return must be equal to (*a*) + (*b*). Profit (*b*) constitutes the premium of an insurance policy against capital loss. On some pieces of equipment it is a just tax; on others unjust.

Unamortized values usually arise because of functional depreciation, not physical. If functional depreciation has become excessive on one piece of equipment, it is likely that the replacing equipment is also going to have a very uncertain life. What better measure of this risk exists than the unamortized value of the replaced equipment? This is a good argument for requiring the replacing equipment to bear the load.

If unamortized value is included in the replacement study the prospective earnings must be equal to profit (*a*) plus the write-off of the unamortized value. If unamortized value is not considered the earnings must equal some arbitrary figure which includes profits (*a*) and (*b*), whether recognized or not. If the correct factors are used the results obtained from the two methods will differ little in most cases. The required profit factor when unamortized value is not considered must not be the same as when it is recognized as a cost. Since the proper use of either method will preserve the capital, the problem becomes one of policy wherein each company must decide whether a single machine should assume the burden of unamortized value which its adoption caused, or if the burden shall be distributed over all the equipment. The important item is to recognize that unamortized values must be accounted for in some manner. Whether one or one hundred machines pays the bill is up to each business to decide for itself. But let's not say it is not a factor in replacement studies just because it may be disguised in some arbitrary required profit factor which resembles the factor of safety of thirty years ago.

E. Paul De Garmo,
University of California.

ENGLISH NOTES

DEVOTED TO THE INTERESTS OF TEACHERS OF ENGLISH IN ENGINEERING SCHOOLS

J. L. VAUGHAN, *Editor*, University of Virginia

Note: The report of the Committee on English in Engineering Schools will be resumed at an early date.

ENGLISH MUST ADVERTISE—AND HOW!*

By JOHN MILLS

Director of Publication, Bell Telephone Laboratories

Conviction of sin is the prime prerequisite for salvation. A godly sorrow for what one has done, or has failed to do, worketh repentance to salvation. Born in a state of natural sin—with body odors, liable to dandruff and stained teeth, subject to headaches, acidosis and ptoses—we are easily convicted of our own unworthy state, strive to keep on the alkaline side of the line and all too frequently get a lift from a cigarette. Convinced of our inferiorities we shuffle along behind the Joneses, keeping up as well as our over-run budget will permit. In the magazine's colored pages our typical wife points out the luxurious new automobile shining in front of the neighbor's house; she needs a new hat and it's almost time for another permanent; we need new curtains too; the kitchen stove is out of date; our radio doesn't have the convenient push-button control; our refrigerator won't give up its ice cubes. There is no health in us. What shall we do to be saved? The advertisers, of course, who so insidiously and continuously have magnified our deplorable state will supply our salvation; but salvation is not free. It is to be attained only through good works; we must labor and exchange our produce for that of the insistent advertiser.

Much, if not most, of advertising which today is directed toward the consuming public skillfully exploits inferiority complexes that the advertising itself has induced or intensified. Correspondence schools, for example, even when they are not rackets, appeal to the

* A paper presented to the English Section of the S. P. E. E., June 20, 1939.

unsuccessful and the underprivileged. In the World Almanac thirty-eight schools present veiled promises of easy success. Ten offer training in writing English or in speaking; and these totals do not include books which are substantially correspondence schools' texts nor the libraries of essential information, the easy reading courses and the collections of convincing words.

"Don't be handicapped" says one advertiser. "Where do you go from here" is a typical question. Another, after excluding men who "know it all," would like to put in the hands of every man "a copy of the book that contains the seeds of 'confidence.'" School A says, "Make words your most useful tools. Write for the free booklet, 'How to Work Wonders with Words.'" School B argues: "Why can't you write? It's much simpler than you think. Inflation or reflation? What is the difference? Ideology or idealism? Verbal or oral? If you use words wrongly, those who know may underestimate your intelligence and education. Be safe from this criticism."

Of most interest to the teacher of English should be the advertisement which says: "Did you ever stop to think why you sometimes make mistakes in English? Why you may use 'who' for 'whom' or spell a word with 'ei' instead of 'ie' or say 'com*par*able' instead of '*com*parable.' The chances are that in school English was made tiresome, boring work for you. Correct English was an irksome 'subject' instead of a steadily growing *habit* with you. Little wonder that many today are judged to be uncultured or uneducated solely because of their unconscious mistakes in English! It seems a crime that English should have been made such an irksome task instead of the fascinating subject it really is. For most persons do not speak and write good English simply because they have never formed the habit of doing so. You can learn to form that habit with my self-correcting device in no more than fifteen minutes a day. By concentrating on just your own mistakes you can quickly make it second nature to write and speak correctly and colorfully."

This last advertisement has been published at least once in full page display in a Sunday edition of the *New York Times*. Don't try to laugh it away; don't be superior and point out that it is directed toward the lower literates of our population—toward those who never had the advantage of education in high school and technical school. Of course its response is largely from those who never went to college but it points a pertinent moral—of which more anon. Meanwhile consider the phenomenon of a man who says in "Who's Who" that he conducted courses in effective speaking (and applied psychology) in business, professional and university clubs, New York, Philadelphia, Washington, London and

Paris, 1912–19 and since 1926. When this man first came to my attention his game was to interest an executive, or the personnel department, of some engineering industrial company in the desirability of a better public appearance on the part of its engineering, or other, employees. The company in many instances underwrote the cost of his public speaking course, arranged its meeting place and selected employees to be its students. In later stages of his career classes were arranged by technical societies for their own members—engineers you will notice—on individual payment of tuition fees. And finally we have this competent instructor telling a large circle of readers how to win friends and influence people.

Remember also the meteoric career of another instructor of the masses: a man ten years older who wrote on how to write short stories, on the art of rapid reading, on how we learn, and later with still more attention to inferiority complexes on "Life Begins at Forty" and "More Power to You."

Who formed the classes which these men taught? Who bought their books? Some, many in fact, were graduates of engineering schools who felt that what was holding them back was their inability to write or to speak with clarity and force. Whether they were wrong in this feeling is irrelevant; important for the present discussion is the fact that they were convicted of sin, paid out good money and attempted, in many cases too late, to work out their own salvation. At some moment in their industrial careers it had been brought home to them that their native language is a medium both for thought and its expression and for the communication of emotions, and that the manner of its use is an indication of the character of the user. As the correspondence schools advertise: "Be safe from criticism and from underestimation of your intelligence and education. Many today are judged uncultured because of their unconscious mistakes in English."

All this the college boy either doesn't know or disregards; and that is particularly true of the most worthwhile of engineering students, of those who are rising rapidly because of their other abilities. It's all too far ahead; he doesn't know that if one meets the president of a large company and finds that he speaks like a cultured gentleman then the vice-presidents whose offices adjoin will be found of the same type. On the other hand, if in the top office you find a near illiterate you will find other illiterates near.

Merit counts, of course; but business men are human beings and in their immediate assistants they consider more qualities than productivity. In the upper levels of most organizations there are likely to be similarities of culture and education; the large variations occur in the lower and less executive levels. The diamond in

the rough, however large, is rarely placed next to the crown jewel; there is usually an intermediate polished stone.

A very good case indeed can be made for a facility in English sufficient to reveal character and intelligence. More obvious, of course, is the every-day use of language as the code through which information is passed from one part to another in business organizations. The man who cannot clearly word a concise report to his superior, who cannot lay down precise instructions for his subordinates is always handicapped no matter what his technical abilities. His road to success is steeper than need be. And frequently it happens that as success is attained the inferiority, for which other abilities have compensated, still persists. It sometimes takes a new but natural form, making of the successful man, whose own use of English is none too lucid, an intolerant critic of the compositions of his subordinates. None can write to please him; letters and memoranda which are passed up to his desk for approval are returned to their authors for needless verbal revisions. He'll fuss over a word without even looking it up in a dictionary to trace its derivation and growth of meaning. And he'll tell, in confidential moments, that so-and-so is a good worker but just can't write a letter or a clear report. Usually he is right; and the pot is justified in accusing the kettle of obscurity.

Not everyone, of course, who criticises college graduates and young engineers for lack of facility in their own language, is suffering from an inferiority complex. But when you find one, my friends who teach English in technical schools, hang on to him. Don't tell him what I have just said—fortunately he wouldn't admit any applicability to himself. You can almost surely count on him for a good testimonial as to the value of English. He will deplore for you the present ineptitude of technical school graduates and plead for more and better English—all over the signature of a man successful in industry.

And this brings us to the practical advice of this paper. English must advertise; let us try to see how it might do so.

You can lead a horse to water but you can't make him drink. You can provide the best imaginable English courses in a technical school but their students won't really wet their muzzles unless they have a thirst. And if they do, pure water will satisfy; it need not be sweet or fizzly. Why are present courses not effective? As answered by the chairman of one English department: "Special interests, prejudices, early environment, college traditions, an unwillingness to do the necessary laborious work"—incidentally, notice the tautology. Would to Heaven that those of us who are exponents of good English could adequately scrutinize our own before we display it. Recovering from this irascible di-

gression, we add that the chairman also mentioned aptitudes and weakness of pre-college training. Excepting these, all the inhibitory conditions are merely the usual obstacles which confront advertisers of tangible products. That they can be overcome one must conclude from the fact that otherwise the correspondence schools whose advertisements were quoted would long since have gone out of business. They succeed, at least to the extent of collecting tuition fees. They sell a service; and to do so they must bring about in the consumer's mind a revaluation of his special interests, overcome his prejudices, make profit out of the deficiencies of his early environment and break down opposing traditions.

The English department in a technical college has more valuable services to sell and its price is lower. If it wants to sell it must advertise; and judged by present successful practices it must intensify and exploit inferiorities; it must stud its copy with success stories and with glowing testimonials. If afraid to do that, it is not keeping step with the times. The idea of advertising may be offensive to some as contrary to the ethical or esthetic standards of the teaching profession. Let those throw the first stone who serve in institutions which do employ one or more of the following agencies: a press representative for the college, a swollen stadium and a headline football team, alumni secretaries, a university press, a legislative lobby and a president who is far from shy. Even marathon-kissing coeds and goldfish swallowers, who operate without official sanction, have called public attention to institutional names. Mayhap "'tis better to be damned than not mentioned at all."

An advertising campaign by a single department of a college might well run counter to the jurisdictional prejudices of other departments and meet opposition from the administration. It certainly would if so undertaken as to give undue publicity to individuals of the department or to appear as competition for curricular hours and student electives. If, however, the emphasis is on the value of facility in the use of our *national* language the advertising becomes as unobjectionable as that for thrift, health and the American way of life. It can still be personalized in its appeal; it need not be abstract or generalized. The burden of its song should be: Good English pays; get the habit now while you are young—after graduation it will be too late. If a college student can be influenced by that idea the task of the English department will be much simplified. Concentrate on that; make him penitently conscious of his deficiencies; and let his need direct him to you. Then your business may expect to prosper in proportion to the satisfaction of your student customers. Today most of them aren't customers; they don't value your services. All too frequently they

are prisoners in your class rooms, locked in against their wills by a curricular requirement.

The advertising campaign and its personnel will be determined for each department by its own situation. In those few institutions where there happen to be departments of journalism or courses in advertising it may be possible to enlist the interest and coöperation of those departments in developing an appropriate and practical campaign. You could present for their consideration an interesting problem—a project for those who are learning how to propagandize—and a definite number of guinea pigs for their experiments.

Your campaign, with minor exceptions to be noted later, would involve no paid advertising. You would get societies, institutions and individuals to plug for you. Governors, regents, farm administrators, Rotary and Kiwanis officers, county surveyors, industrialists, bankers, 4-H club leaders, newspaper owners, patriotic societies, ministers, parent-teacher associations—from all these it should be relatively easy to get assistance. Most of them will be flattered by the invitation. The more successful they are the more chance there is that they would like to feel they have exceptional ability to make themselves clear and to put their own ideas across by persuasive wording. You can count on them for testimonials. Get them to work a plug for English into some of their public or semi-public appearances and use their influence to get your other copy published. To know the English language well is good Americanism. Don't forget the farm papers and home town papers of the places from which your students come. Put on a state wide campaign. Interest the chapter advisors of fraternities which take engineering students; try for stuff in their national journals. Enlist the interest of your own college paper. See what support you can get from your alumni magazine.

What sort of copy will you try to place? Short, lively, timely if possible, concrete and well written, in content unacademic, anything at all which can help to spread the gospel that good English pays. To some it may pay only in inner satisfaction, to some in dollars and to others in reputation. Conversely, inability to write or talk clearly results in confusion, delays, inefficiency and misunderstandings which are accompanied by losses of money, reputation or pride. Capitalize the class room bulls in the humor page of your college paper. If possible submit them to the editor in cartoon form or as captions for appropriate line drawings. Exploit every mistake in English of which you learn when that will not result in ill will and animosity toward your publicity campaign and its purpose.

Enlist if you can, and perhaps it could be done through the officers of the S. P. E. E., the assistance of the large industrial

employers of technical graduates. It might be that they would be willing to note in some of their advertisements in college and alumni magazines or papers that English is of value in business. Get placement agencies to make similar statements and if possible to incorporate into their qualification records data as to the English ability of the applicant.

Don't forget the importance of testimonials as to the value of good English from your colleagues. There is, I believe, rarely any difficulty in getting agreement on the part of successful professors of engineering subjects to the proposition that ability to use good English will be helpful to their students after graduation. Nor is there usually much difficulty as to the converse proposition. The trouble starts when the engineering professor fears an encroachment on the class and preparation hours which the student can devote to his particular engineering subjects. Your publicity campaign must soft pedal that possibility. It must assume that the desired result can be accomplished without increasing the nominal demands of your department upon students' time. The desired result must be expected from more efficient study and class room work, because of greater student interest and more practical motivation. Your class room exercises, with students who are vitally interested, can easily be made many times more effective and their tempo advanced from the adagio of the present to allegro at least. Approached on that basis your colleagues should have no apprehensions and should readily sign some well worded, but very short, statement which you can use in your advertising.

Such a testimonial if adequately displayed can work miracles in revolutionizing student attitudes toward English. It might be run as a paid advertisement in the college paper. To pay for it a collection could be taken from the testifiers themselves. Half-a-dollar a piece would be sufficient to allow the advertisement when published to run the note "Paid for by Members of the Engineering Faculty." Later you can run a variant as paid by your own staff or by some contributor, for example an alumnus whose name will carry weight. Faculty backing of its pedagogical opinion by dollars has all the news value of a man-bitten dog. Paid signed advertising to affect public opinion is honest; and it can be effective too if it is truly in the interests of the public toward which it is directed.

English must advertise. But let's not advertise with sky writing if our public is blind. I mean that all we say in S. P. E. E. journals and the like is beyond the ken of students. We conduct section meetings and I suppose each English department has its own prayer meetings, but souls aren't saved by gatherings of the faithful. Someone must go out into the highways and the byways. If we

really believe what we say about our English language let us put some punch behind our words and say them where we want the effect to be produced. Start your campaign for the students in your own institution but as soon as you can safely expand it include the high schools from which your students come. This means a long term program demanding continuous attention but it is probably the only way to accomplish our desiderata.

Appendix

The manuscript of this paper was presented by its author to two men who are expertly qualified to appraise its statements or conclusions. The first is a financier who knows the officers and directors of a wide variety of business organizations. He was asked to comment on the portion dealing with the value of English in business relationships; and is quoted below. The other reader, an expert in public relations and in the development of advertising campaigns, was asked about the program which the paper suggests. Neither was a member of any Bell System Company. The author of the paper is deeply grateful to both men and he is preserving their anonymity.

Comments of the financier:

I read your treatise on the use of language with a good deal of pleasure. I like the first three-quarters better than the last quarter but I appreciate that it is necessary to drive a point home to a group with vigor and some repetition. You have asked for my comments and although I don't think that they can be of very much value, I must say that I heartily agree that one of the main attributes of people who are successful in business is the ability to express themselves clearly and concisely. That factor, added to sound judgment and good technical and executive capacity, should result in success in every line. As you have said, many, otherwise well qualified, fail to achieve full success through lack of ability to express themselves properly orally and in writing. The principal failing of many men is that they go on and on like the brook and around and around like the music until the patience of the auditor is exhausted, and the matter under discussion, even though it may have merit, dies aborning. I always get a thrill of pleasure whether in a public speech or in a private conversation when I receive a cogent exposition with no waste of words. I should think that the formation of good English reading and speaking habits should be adopted as early as possible and nothing is more important in the formation of such good habits than the reading of authors old and new who possess the gift of clarity and brevity.

Comments of public relations representative:

The suggested program to "advertise English" appeals to me as good sense—and good business—for everybody involved. It is practical, logical,

and based on sound principles of salesmanship. As such, it is definitely workable.

Creating a desire for good English is, obviously, something not to be accomplished over night. It should have its first seeding in the very early years of the student . . . progressing under the influence of school and social environment, parental example, and the young person's associations. This is where the proposed long-term program comes in, reaching into the high schools. But one must start somewhere, sometime, or new things would never get started at all. The point is, to start right where you are (which becomes the heart center of the project); then work out, about and around from there, sinking the roots deeper each time.

It is quite obvious that today, when there are many voices all crying their wares, no ware, tangible or intangible, is going to get itself sold unless it gets itself before the public. And these days, the way is: Advertise! Not half-heartedly; not semi-professionally, but straight from the shoulder, employing proven, practical methods and directing copy to the people you want it to hit. Mr. Mills' campaign would do just that. He is suggesting that English be put on a business basis: for our young engineers; for our institutions; for our nation. I find it entirely commendable that English, no less than business or government, should make itself pay.

MECHANICAL ENGINEERING PAGE

R. L. SWEIGERT,

Georgia School of Technology, *Editor*

COMMITTEES FOR 1939–40

Executive Committee:

C. H. Casberg, Chairman, University of Illinois
G. L. Tuve, Secretary, Case School of Applied Science
F. D. Carvin, Newark College of Engineering
C. W. Ham, University of Illinois
A. B. Domonoske, Stanford University
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B. H. Jennings, Lehigh University

THE T-SQUARE PAGE

DEVOTED TO THE INTERESTS OF THE
DIVISION OF ENGINEERING DRAWING

A. W. LEIGHTON, *Editor*, Tufts College

1939 NATIONAL DRAWING COMPETITION

SPONSORED BY THE DIVISION OF ENGINEERING DRAWING AND DESCRIPTIVE GEOMETRY OF THE S. P. E. E.

State College, Pennsylvania

Classification	Code No.	Instructor	Student	Institution
Class AP				
First Place...	251	Jasper Gerardi	Michael Sharoff	Univ. of Detroit
Second Place.	371	R. K. Jacobs	L. K. Howes	Ga. School of Tech.
Third Place..	21	E. J. Marmo	Rueben Silver	Univ. of Nebraska
Class AI				
First Place...	72	J. P. Oliver	LeRoy Brown	A. & M. of Texas
Second Place.	452	Matthew McNeary	Charles T. Keniston	Univ. of Maine
Third Place..	122	H. B. Howe	R. L. Elliott	Rensselaer Poly.
Class BP				
First Place...	23	J. B. Cecil	William Versaw	Univ. of Nebraska
Second Place.	373	J. P. Vidosic	R. R. Drummond	Ga. School of Tech.
Third Place..	253	Jasper Gerardi	Robert J. Pocock	Univ. of Detroit
Class BI				
First Place...	254	Jasper Gerardi	Kenneth C. Fey	Univ. of Detroit
Second Place.	374	B. L. Brown	F. W. Stopinski	Ga. School of Tech.
Third Place..	124	H. B. Howe	Leo L. Helterline	Rensselaer Poly.
Class CI				
First Place...	125	J. S. Rising	Robert Warner	Rensselaer Poly.
Second Place.	95	C. C. Perryman	Eddie Mills	Texas Tech.
Class CS				
First Place...	376	R. K. Jacobs	A. M. Ginsburg	Ga. School of Tech.
Second Place.	76	T. H. Terrell	L. C. Streater	A. & M. of Texas

Classification	Code No.	Instructor	Student	Institution
Class D				
First Place...	357	C. P. Buck	John W. Gilbert	U. of Notre Dame
Second Place.	417	Robert T. Henning	Earl Franzen	Burlington J. C. (Burlington, Iowa)
Class E				
First Place...	78	R. O. Loving	Bradford Hardie	A. & M. of Texas
Second Place.	308	R. Bockhorst	Kenneth E. Schreiner	Washington Univ. (St. Louis)
Third Place..	98	W. E. Street	Billy Power	Texas Tech.
Class F				
First Place...	259	Jasper Gerardi	William L. Lennemann	Univ. of Detroit
Second Place.	149	R. S. Crossman	V. L. Rugen	Univ. of Illinois
Third Place..	329	A. W. Leighton	Richard J. Coar	Tufts College

COMMENTS OF JUDGING COMMITTEE

1. In some cases the best drawings were awarded places even though, in the opinion of the judges, they contained errors.

2. Several drawings were eliminated from placing because of no identification.

3. Some drawings were eliminated, even though excellently done, because specifications were not completely followed.

4. The judges are of the opinion that the materials to be available for freehand drawing should be definitely specified in future contests.

Judging Committee:
F. R. FINCH,
RALPH S. PAFFENBARGER,
JOHN T. RULE, *Chairman.*

June 20, 1939

Editor's Note.—(The judges examined 198 entries from 33 institutions in 1939, as compared with 190 entries from 30 institutions in 1938, and 185 entries from 30 institutions in 1937. In addition to the comments given above, the judges recommended that a note be added to all dimensioned pictorial drawings used in future competitions, stating that the competitor should not be influenced in *placing* his dimensions by the arrangement of the same on the pictorial drawing. The Chairman of the National Drawing Competition for 1939–1940 is Stanley G. Hall, 314 Transportation Building, University of Illinois, Urbana, Illinois.)

NECROLOGY

ARTHUR EDWIN KENNELLY was born near Bombay, India, December 17, 1861, and died in Boston, Mass., June 18, 1939.

Professor Kennelly received his early education in England, Scotland, France, and Belgium. He received the honorary degree of doctor of science from the University of Pittsburgh in 1895, and from the University of Toulouse, France, in 1922; the honorary degree of master of arts from Harvard University in 1906. He was professor of electrical engineering at Harvard University from 1902 to 1930. From 1913 to 1924 he held the same title at the Massachusetts Institute of Technology. At his death, he held the title of professor emeritus of electrical engineering at Harvard and M.I.T. He was a member of many scientific societies both in this country and abroad and was the recipient of many awards, among them the Edison Medal of the American Institute of Electrical Engineers; the Institution Premium and Fahie Premium of The Institution of Electrical Engineers, Great Britain; Longstreth and Howard Potts medals, Franklin Institute; the cross of a Chevalier of the French Legion of Honor; the Mascart Medal of the Société Française des Électriciens.

JOSEPH WALTER RAMSAY, Professor of Electrical Engineering at the University of Texas, died July 22. As had been his custom for many years, he was spending the summer on research work for the Southwestern Bell Telephone Company in Dallas. He was stricken with pneumonia and died within a week. The sad news of his death came as a great shock to his colleagues and students at the University, and to hundreds of ex-students who had known and loved him as an excellent teacher and an ever-helpful friend.

Professor Ramsay was born on November 25, 1880, at Bloomington, Indiana, the son of the late John A. and Catherine Elizabeth Ramsay.

Professor Ramsay received his B.S. in E.E. degree at the Agricultural & Mechanical College of Texas in 1902, and in 1916 he received his B.S. in E.E. and E.E. degrees from the University of Texas. In 1911, Professor Ramsay joined the faculty of the Department of Electrical Engineering of the University of Texas as an instructor, and held this position until 1917, in which year he enlisted in the United States Air Service as a second lieutenant. He was placed in charge of the Department of Aerial Gunnery of the School of Military Aeronautics, the large aviation ground school lo-

cated on the University of Texas campus. He later received training at Kelly Field, and, at the close of the War, because of his fine handling of the Department of Aerial Gunnery at S.M.A. at the University, he was slated to head a similar department in one of the largest aviation centers in the country. After the War he spent one year teaching electrical engineering at Washington State College, and then one year as an assistant professor of electrical engineering at Texas A. & M. College. In 1921 he rejoined the staff of the Department of Electrical Engineering at the University of Texas as an adjunct professor. In 1925 he received his associate professorship, and in 1938 he was elevated to the rank of full professor.

At the University Professor Ramsay was a member of the Science Club; Secretary of the University Engineers Loan Fund; a member of Eta Kappa Nu, honorary electrical engineering fraternity; a member of the University Aeronautical Society; and was prominently identified with church and patriotic activities. He was a member of the University Presbyterian Church, and was active in American Legion circles.

He was a member of the American Society of Electrical Engineers, and the Society for the Promotion of Engineering Education, serving the latter as Secretary of the Texas chapter. He was also a member of the American Institute of Electrical Engineers; Sigma Tau, honorary engineering fraternity; Reserve Officers Association; and Delta Sigma Phi, social fraternity.

His research work for the Bell Telephone Company and Texas industrial concerns on the general problem of corrosion was well known, and he had written many papers and given many talks on the subject.

Professor Ramsay was always popular with his students because of his pronounced ability as a teacher, and because he was endowed with a lovable personality. He was keen-minded, straight-thinking, productive, and forceful. He was held in high esteem by his associates in the College of Engineering and throughout the general faculty of the University of Texas, and his passing leaves many sad hearts. The University of Texas has lost a fine teacher; Texas has lost an outstanding engineer.

H. E. DEGLER

COLLEGE NOTES

Linton E. Grinter, Director of Civil Engineering Curriculum and Dean of the Graduate Division of **Armour Institute of Technology,** has been appointed Vice-President of the Institute. He will also continue as Dean of the Graduate Division. Augmenting the staffs of the mechanical and civil engineering departments, five new appointments to the faculty have been made: Lloyd H. Donnell, Associate Professor of Mechanical Engineering. Dr. Donnell received his Bachelor's degree in Mechanical Engineering and his Doctor's degree in Applied Mechanics at the University of Michigan. Author of numerous papers in the field of mechanics and aeronautical engineering, he has taught mechanical engineering at the University of Michigan and at the California Institute of Technology. Dr. Donnell resigned his position as director of stress analysis and structural research departments of the Goodyear Zeppelin Corporation to accept his present position at Armour Institute; Instructor in Mechanical Engineering, N. B. Nottage, a graduate of the University of California. Mr. Nottage has been doing graduate work and teaching at that Institution since 1937; Eugene Murphy, Jr., a graduate of Cornell and Syracuse Universities, part-time Instructor in Mechanical Engineering. He comes to the Institute from the engineering department of Ingersoll-Rand where he has been employed for the past two and a half years.

Merit P. White has been appointed Assistant Professor of Civil Engineering, and LeVan Griffis instructor in Civil Engineering. Dr. White is a graduate of the Thayer School of Civil Engineering at Dartmouth and the California Institute of Technology. He has done research work in the Graduate School of Engineering at Harvard and for the past year has been research assistant at the California Institute of Technology. Mr. Griffis graduated with honors from the California Institute of Technology in 1937 and received his Master's degree in civil engineering the following year. At the present time he is working toward his doctorate from the same institution.

Through the aid of the W.P.A. and P.W.A., the **New Mexico School of Mines** is under a rather extensive building program which is expected to be completed for the beginning of the school year of 1939–1940. Four new buildings are being erected; these are a new engineering building, a petroleum engineering building, an assay building, and another men's dormitory. These buildings are equipped with the most modern laboratories as required by the different departments. The estimated cost of these projects is $320,000.00.

NEW MEMBERS

BUERER, WAYNE W., Assistant Professor of Mechanical Engineering, Oklahoma A. & M. College, Stillwater, Okla. E. C. Baker, R. G. Saxton.

CAMPBELL, WM. B., Assistant Professor at Colgate; 6848 N. 7th St., Philadelphia, Pa. W. J. Stevens, C. D. Fawcett.

COVER, GERALD M., Associate Professor of Metallurgy, Case School of Applied Science, Cleveland, Ohio. H. R. Young, R. R. Slaymaker.

DUNGAN, WALTER M., Associate Professor of Theoretical and Applied Mechanics, Iowa State College, Ames, Iowa. Glenn Murphy, H. J. Gilkey.

FORD, LESTER R., Professor and Chairman, Dept. of Mathematics, Armour Institute of Technology, Chicago, Ill. H. T. Heald, C. C. Tibbals.

KAMPMEIER, ROLAND A., Associate Professor of Hydraulic Engineering, University of Tennessee, Knoxville, Tenn. C. S. Camp, F. W. Trezise.

MACKINNON, JOSEPH C., Registrar, Massachusetts Institute of Technology, Cambridge, Mass. C. E. Tucker, E. L. Moreland.

MCMASTER, ROBERT C., Instructor in Electrical Engineering, Case School of Applied Science, Cleveland, Ohio. T. M. Focke, H. R. Young.

MYKLESTAD, NILS O., Instructor in Mechanics, Cornell University, Ithaca, N. Y. C. W. Armstrong, W. R. Cornell.

PEIRCE, GEORGE R., Instructor in Electrical Engineering, University of Illinois, Urbana, Ill. H. W. Horn, A. R. Knight.

SMITH, FRANK H., Assistant Professor of Mechanism and Engineering Drawing, University of Michigan, Ann Arbor, Mich. H. W. Miller, E. L. Eirksen.

TENNEY, EDWARD A., Assistant Professor of English, Cornell University, Ithaca, N. Y. J. R. Moynihan, W. N. Barnard.

TREZISE, FRED W., Professor of Engineering, Lawrence College, Appleton, Wis. For re-admission.

WAGNER, WARREN O., Assistant Professor of Civil Engineering, University of Nevada, Reno, Nev. Franklin Thomas, R. W. Sorensen.

WINDING, CHAS. C., Assistant Professor of Chemical Engineering, Cornell University, Ithaca, N. Y. C. W. Armstrong, W. R. Cornell.

SECTIONS AND BRANCHES

The **Allegheny Section** will meet at Bucknell University, Lewisburg, Pa., on Friday and Saturday, October 13 and 14, 1939. The theme of the meeting will be New Fields for the Engineer. Charles S. Keevil, Chairman, will preside.

At the general session Friday afternoon Frederick M. Feiker, Executive Secretary of the American Engineering Council, will give the principal address. At the dinner Friday evening, Paul Wooten, Washington Correspondent of the McGraw-Hill Publishing Company, will be the speaker.

The usual departmental conferences will be held Saturday morning.

At the Spring Quarter Meeting of the **Minnesota Section** of the S. P. E. E. the following officers were elected for the 1939–40 school year:

Chairman, H. B. Roe, University of Minnesota, St. Paul, Minn.
Secretary, F. E. Miller, University of Minnesota, Minneapolis, Minn.
Chairman, Program Committee, R. F. Schuck, University of Minnesota, Minneapolis, Minn.

A. B. ALGREN,
Secretary.

The Fall Meeting of the **New England Section** is to be held at Northeastern University on Saturday, October 14. The program which is now nearing completion is tentatively as follows:

9–10 A.M. Registration.
10–12 A.M. Conferences.
A. Chemical Engineering.
Chairman: W. J. Nolan, University of Maine.
Subject: The Teaching of Unit Processes.
Speakers: M. C. Molstad, Yale University; H. C. Weber, M. I. T.
Subject: The Teaching of Industrial Chemistry.
Speaker: W. K. Lewis, M. I. T.
B. Civil Engineering.
Chairman: F. W. Stubbs, Jr., R. I. S. C.
Subject: Structural Snarks.
Speaker: Hardy Cross, Yale University.

Subject: Soil Mechanics in the Foundations Course.
Speaker: W. P. Kimball, Dartmouth College.

C. Electrical Engineering.
Chairman: W. H. Bliss, University of Maine.
Subject: The Place of Cost Problems in Electrical Engineering Instruction.
Speaker: M. S. McIlroy, M. I. T.
Subject: How Much and What Kind of Mathematics Should an Electrical Engineer Have?
Speaker: E. A. Walker, Tufts College.

D. Mechanical Engineering.
Chairman: W. D. Emerson, Norwich University.
Subject: Should the Content of the Mechanical Engineering Curricula, *i.e.*, Ground Covered be Condensed in Favor of High Order of Accomplishment or Should Content be Expanded Accepting Lower Order of Accomplishment?
Speakers: R. E. Flanders, Springfield, Vermont, Representing industry; E. D. Smith, Yale University; E. MacNaughton, Tufts College.

12:30 P.M. Lunch.

1:30–3:00 P.M. Laboratory Inspection.

3–5 P.M. Conferences.

E. Drawing, Design, and Shop Work.
Chairman: Edgar MacNaughton, Tufts College.
Subject: Drawing and Shop Courses for Everyday Needs.
Speaker: A. L. Townsend, M. I. T.
Subject: Shop Courses at Yale (?).
Speaker: E. O. Waters, Yale University.

F. Mathematics and Physics.
Chairman: S. W. Dudley, Yale University.
Subject: Mathematics and Physics for Engineers.
Speaker: J. C. Hunsaker, M. I. T.

G. Mechanics.
Chairman: Dana Young, Connecticut State College.
Subject: Applied Mechanics in Industry and in the Curricula of Engineering Schools.
Speaker: C. R. Soderberg, M. I. T.

6:30. Annual Dinner.
Subject: "International Relations."
Speaker: Anton de Haas, Harvard University.

Arrangements are being made for the entertainment of the ladies, which will include visits to points of interest in Boston and vicinity. These will be concluded in the afternoon so that the ladies will be able to attend the annual dinner.

Minutes of the 8th Annual Meeting of the **Texas Section** held at the University of Texas, April 7–8, 1939.

The meeting was called to order with Chairman Sophus Thompson, Southern Methodist University, presiding. 148 members and guests were registered. An address of welcome was delivered by H. T. Parlin, Acting President of the University of Texas. M. C. Hughes of Texas A. & M. College responded.

C. W. Crawford, A. & M. College, then presented a paper entitled "Orientation of Engineering Freshmen, Problems versus Lecture Method." Prepared discussions of this paper were presented as follows:

O. V. Adams, Texas Technological College, presented by H. F. Godeke in Dean Adams' absence; J. W. Ramsay, University of Texas; J. W. Greeley, The Rice Institute.

Considerable open discussion of the paper followed. Among those participating were the following:

A. H. Burr, The Rice Institute, who explained a system of pre-college orientation tests in use at Worcester Polytechnic Institute. I. H. Pound, The Rice Institute, told of devices used at his school to hold students interest in engineering and to give them light on engineering as a career. Roy C. Green, A. & M. College, inquired as to the fate of A. & M. students who do not make the grade in the tests described by Professor Crawford. R. M. Matson, Southern Methodist University, related that his school follows a program similar to that described by Professor Pound. R. A. Seaton, Kansas State College, told of the Summer Normal course given by Dean J. W. Barker, Columbia University. C. V. Bullen, Texas Technological College, asked how teachers are selected for the orientation classes. Chairman Thompson asked if an appreciable decrease in physics failures was noticeable after the "problem course" stopped. To Chairman Thompson's query, Professor Crawford replied that physics failures had dropped from 50 per cent average to 30 per cent average; and to Professor Greely's question he said that practically 100 per cent of the students failing in the problem course failed also to graduate in Engineering.

C. E. Rowe and W. H. McNeill, University of Texas, exhibited an interesting collection of models prepared during a period of several years to assist in teaching mechanical drawing and descriptive geometry.

Prepared discussions relating to this subject were presented by F. M. Smith, North Texas Agricultural College; F. A. Decker, Texas School of Mines.

The banquet was held in the Crystal Ball Room of the Driskell Hotel, Toastmaster, E. C. H. Bantel. Following the dinner the

ladies retired to the hotel parlor for entertainment. The conference was then addressed by the following:

James M. Robert, Dean of Engineering, Tulane University, Engineering and Social Progress.

M. C. Stone, Head, Department of Engineering, N. T. A. C., The Proposals for Development in Aeronautical Education.

R. A. Seaton, Dean of Engineering, Kansas State College, Representative of National Council of S. P. E. E., Continuance of E. C. P. D. Activities.

T. U. Taylor, Dean Emeritus of Engineering, University of Texas, An Historical Survey.

Department sessions were held Saturday morning by the following groups:

Architecture and Civil Engineering, J. A. Focht, Chairman.
Engineering Drawing, W. H. McNeill, Chairman.
Electrical Engineering, R. W. Warner, Chairman.
Petroleum and Chemical Engineering, H. H. Power, Chairman.

At the general session C. V. Bullen, Professor of Electrical Engineering of Texas Technological College, presided. The Value of Engineering Research in the College of Engineering, prepared by R. L. Peurifoy, Director, Division of Engineering, Texas College of Arts and Industries, was presented by A. W. Straiton, same school.

Prepared discussions of this paper were presented by the following:

T. R. Spence, Texas A. & M. College.
R. D. Landon, Southern Methodist University.
W. R. Woolrich, The University of Texas.

In the open discussion of this paper, the following participated:

F. E. Giesecke, Texas A. & M. College, who discussed the importance of research to practical engineering. E. P. Schoch, The University of Texas, who stressed the vital importance in research of employing experienced men for this work and of giving them adequate time if they are to obtain valuable results.

The Place of Engineering Colleges in the Continuation of Education after the Baccalaureate Degree, prepared by O. V. Adams, Dean of Engineering, Texas Technological College, was presented by O. A. St. Clair.

Prepared discussions of Dean Adams' paper were presented by Dean Gibb Gilchrist, A. & M. College; and Dean E. H. Flath, Southern Methodist University.

In the open discussion following, Dean Flath emphasized the value to graduate of having had, during his undergraduate days, experience in public speaking. He further stressed a need for the colleges to encourage students in doing research on their inventive ideas. J. J. Richey, Texas A. & M. College, favors post-graduate conferences and suggests a committee be appointed to study this question, reporting back to the conference next year. S. G. Lutz, Southern Methodist University, believes colleges should serve to stimulate students to carry on their technical study systematically, after graduation. He explained the "check-up" system now employed by Southern Methodist University with its coöperative students.

Fred Rightor, Secretary, Texas State Board of Registration for Professional Engineers, speaking informally, related some of the "Sidelights Gleaned During Two Years of Engineering Registration in Texas." He plead for accuracy when candidiates are being recommended to the Board for licensing.

At the afternoon session the annual report of the Secretary-Treasurer was received and ordered recorded in the Minutes.

The Section voted unanimously to accept the invitation from the College of Mines to hold the 1940 Meeting at that school. Rice Institute filed its invitation for the Section to meet at Houston in 1941.

After some informal discussion of the desirability of uniting with the Texas Section, the schools of several of the states adjoining Texas, a motion was made by J. A. Focht, that a committee be appointed to study this question and bring in recommendations at the 1940 meeting. M. C. Hughes moved that the matter be referred to the Executive Committee. This motion prevailed.

The report of the Nominating Committee was presented and the following officers unanimously elected:

For Chairman: H. E. Degler, University of Texas.
For Vice-Chairman: J. W. Kidd, Texas College of Mines.
For Secretary-Treasurer: J. W. Ramsay,* University of Texas.
For Executive Committee Members, Terms to Expire 1942: F. L. McKee, Texas Technological College; R. N. Matson, Southern Methodist University; R. L. Peurifoy, College of Arts and Industries.

The Section voted unanimously to express to the National Secretary its thanks for sending Dean R. A. Seaton to represent the Council at this meeting.

* Professor Ramsay died July 22 and H. C. Dillingham, A & M. College, has been appointed.

At the 1938 meeting at A. & M. College a committee was appointed to make recommendations for revising the Constitution. This Committee consisted of Phil M. Ferguson, University of Texas, and J. H. Murdoch, Texas Technological College. Recommendations were made for revising Sections 6 and 8 and for adding a new section, No. 10. These revisions were unanimously adopted. They are as follows:

Section 6. EXECUTIVE COMMITTEE.

There shall be an Executive Committee which shall consist of a Chairman, Vice-Chairman, Secretary-Treasurer of the Section, and one member from each of the colleges in the State which maintains a course in engineering.

Section 8. ELECTION AND TERMS OF SERVICE.

The officers of the Section shall be elected annually at the annual meeting. The members of the Executive Committee representing each of the colleges shall be elected to three year terms so staggered that approximately one-third are elected at each annual meeting.

ALL terms of service shall begin immediately after the annual meeting at which elections occur.

Section 10. VACANCIES.

In case of a vacancy in the office of Chairman, the Vice-Chairman shall succeed. Any other vacancies shall be filled by appointment by the Chairman.

A Resolutions Committee, appointed at the 1938 meeting and consisting of J. S. Waters, R. D. Landon, and J. W. Ramsay, Chairman, presented resolutions upon the death of Professor James A. Correll, past President of this Section. These resolutions were unanimously adopted.

R. M. Matson, Chairman of the Resolutions Committee appointed for this meeting, presented the following resolutions which were unanimously adopted:

Whereas, the Eighth Annual Meeting of the Texas Section of the Society for the Promotion of Engineering Education has been enjoying the hospitality of The University of Texas and

Whereas, the success of the meeting has been due to the courtesy and efficiency of our hosts in making the preparation for the meeting, now

Therefore, be it Resolved, that we express our appreciation of the officials of The University of Texas for the privilege of holding our meeting on this campus and to the Engineering Faculty of The University of Texas for their painstaking efforts for our entertainment and pleasure during our stay and to the Ladies

of The University of Texas for courtesies and entertainment of the Ladies; and, further

Be it Resolved, that we make particular mention of the sumptuous banquet on Friday evening at the Driskill Hotel, and the delicious and appetizing breakfast served by the Engineering Faculty of The University of Texas on Saturday morning; and further

Be it Resolved, that we express our appreciation to the S. P. E. E. for sending to us as their representative, Dean R. A. Seaton of Kansas State College, and that we suggest that a copy of this resolution be spread upon the Minutes of the Texas Section of the Society for Promotion of Engineering Education.

Respectfully submitted,

RAY M. MATSON,
Southern Methodist University.
A. J. HARTSOOK,
Rice Institute.
L. M. HAUPT, JR.,
A. & M. College.

ELECTRICAL ENGINEERING DIVISION

Chairman: R. W. Warner. Attendance: 27.

The first topic discussed was "How to promote guidance of High School seniors thinking about engineering."

R. W. Warner, University of Texas, opened discussion on this topic by pointing out that the problem is one of the projects that has been undertaken by E. C. P. D. He also mentioned the fact that the A. I. E. E. has published a booklet "The Electrical Engineer" that is useful in guidance of prospective engineers. This booklet is now out of print, but is to be revised and reissued soon.

M. C. Hughes, A. & M. College, suggested that this topic would be suitable for an educational research project. He believed that a vocational test or questionnaire could be developed that would be given to prospective engineering students to help determine whether or not they might expect to be successful in the engineering profession.

R. A. Galbraith, University of Texas, mentioned the fact that some A. I. E. E. Sections have been doing good work in the field of guidance. He cited the work done by the Detroit section which gives a dinner for high school students at which educators and men from industry talk to the students regarding the electrical engineering profession and try to tell them what they may expect to find when they get out in industry. He suggested that A. I.

E. E. Sections in Texas might be willing to coöperate in a similar project.

F. A. Decker, College of Mines, described the work done at the College of Mines. There, faculty members and business men are invited to the high schools each year to talk to the students regarding engineering as a profession. Emphasis is put on the requirements of the engineering profession with respect to the qualities or aptitudes that a student must possess.

M. C. Stone, N. T. A. C., described the guidance and orientation work at N. T. A. C. Each student, upon entering the college, fills out an application blank containing questions regarding likes and dislikes, and takes an aptitude test. The results obtained from the questionnaire and the aptitude test are checked against the student's record as shown by his high school transcripts. An attempt is made to have a faculty member interview every new student. They also try to get prospective students to bring their parents and come to the school for an interview prior to registration.

L. L. Grandi, Texas A. & M., suggested that students should not have to choose any particular branch of engineering at first.

R. W. Warner, University of Texas, in response to Mr. Grandi's suggestion remarked that this was being achieved by the uniform freshman year in engineering.

S. H. Van Wambeck, Rice Institute, pointed out that what is needed now is some guidance prior to the time the students decide on engineering as a profession.

Roy Burdett, N. T. A. C., suggested that one of the main problems in guidance is to "debunk" engineering and take out the glamour.

E. M. Harrison, S. M. U., referring to Professor Hughes' suggestion of a vocational test and questionnaire, stated that the purpose of the test should be to give the student information to enable him to orient himself.

E. H. Flath, S. M. U., stated that the tests should serve two purposes: (1) to give the students information regarding his capabilities; (2) to give the faculty information regarding the student. He cited the guidance experience at S. M. U. in which a large number of students have been tested. He suggested that one thing that is essential is to have personal conference with students.

F. A. Decker, College of Mines, stated that as a result of tests made in several states, it has been found that students feel that their contacts with professional men have influenced their choice of professions more than the guidance they received in high school.

C. R. Granberry, University of Texas, pointed out that a problem closely associated with guidance program is that of giving proper attention to junior College transfer students. He stated that the action of senior institutions in accepting, without qualification, the credits of some junior colleges is, in effect, misguidance since some junior colleges do not adequately prepare the student for advanced work at senior institutions.

R. W. Warner, University of Texas, pointed out that some students come to college unprepared for the work they get there, owing to the fact that their high school courses have not been suitable as pre-college training. He read a quotation from an address by President Conant of Harvard University which stressed the dangers of letting our preparatory schools put too much emphasis on trade instead of fundamentals.

The second topic for discussion was "How to handle both weak and exceptionally strong students."

S. H. Van Wambeck, Rice Institute, stated that his experience had shown that extra sessions with the poorer students had proved to be very helpful.

E. J. Howell, A. & M., raised the question of what to do with poor students who repeatedly take the same course in an attempt to get a passing grade.

R. W. Warner, University of Texas, pointed out that here are two questions involved in this problem: (1) the question of how to weed out poor students; (2) the question of pushing poor students through when they should be encouraged to change professions.

S. G. Lutz, S. M. U., stated that his experience with very small classes had shown that it was feasible to set higher standards for the better students and to make them meet the standard.

H. C. Dillingham, A. & M. College, stated that an attempt had been made to sectionalize students into four groups according to ability and that the results of the experiment had shown that students in the high and low groups had both done poorly. He suggested that the students like to "show off" sometimes and that the poorer students were not stimulated when segregated from the better group.

M. C. Stone, N. T. A. C., cited experience on guidance committee. Stated that we may expect to have a five-year course.

RALPH A. GALBRAITH,
Acting Reporter.

MECHANICAL ENGINEERING DIVISION

Chairmen: V. L. Doughtie and J. H. Pound. Attendance: 21.

The subject submitted for discussion was "The Field of

Mechanical Engineering as Related to Other Fields of Engineering."

Professor H. F. Godeke of Texas Technical College opened the discussion. Professor Godeke discussed the problem of encroachment, into the Mechanical Engineering courses, of other departments by way of demands for special sections of courses such as Thermodynamics, etc., for these various departments. In his opinion it is doubtful if such courses should be attempted in small schools, but rather to sell these departments on the idea of the necessity of giving students the basic materials instead of specific or specialized material. It was his opinion that anyone having the fundamentals of a course could easily apply them to special cases.

Discussion from the floor:

A. H. Burr, Rice Institute, brought out the necessity of shortening the course to fit the time allowed which left little or no time for special applications if the fundamentals were to be thoroughly covered. He stated that the time allowed was cut to a minimum now in order to give a rounded course in four years.

R. M. Matson, S. M. U., stressed the importance of making the student realize the importance of these service courses, and that they were not put in to take up time. The Instructor should try to show the relation of these courses to the student's particular field as much as possible.

H. E. Degler, Texas University, mentioned the problem of overlapping material given by different departments. It was his opinion that such courses must be carefully correlated in order to avoid covering the same material.

C. J. Eckhardt, Texas University, discussed the possible extension of the course to five years to more thoroughly cover essential courses.

J. M. Robert, Tulane University, reviewed the subject and stressed the point that the instructor was in a large measure responsible for the success or failure of any course.

C. W. Crawford, Texas A. & M., stressed the point that no instructor should knock or degrade any course but should try to show the student the vital need of the material offered.

H. L. KENT,
Acting Reporter.

BOOK REVIEWS

Mechanism. KEOWN AND FAIRES. McGraw-Hill Book Co., Inc. Fourth Edition. 282 pages.

The fourth edition of this standard text has not been radically changed. A short chapter on accelerations has been added and also material on the universal joint, rolling curves, the Geneva motion and the Gleason system of bevel gearing. The instant center method is used for velocities while accelerations are treated by the relative acceleration method. Many of the problems in the third edition have been replaced with new ones and a number have been added making a total of 415.

The reviewer believes that this book is well suited as a text for an elementary course in mechanism for sophomore or junior engineering students.

THOS. G. BECKWITH

The Economics of Business Enterprise. WALTER RAUTENSTRAUCH. First Edition. 1939. John Wiley & Sons, Inc. 9 chapters, 445 pages, 48 tables. Price $4.00.

As the author has stated in the preface to this book a more appropriate title would be "An Introductory Text on Some Economic Problems of Business Enterprise." As one reads through the book it seems apparent that an effort is being made to show how an estimation of the possibilities of future economic events in business may be made. One hundred figures are included throughout the book which assist the reader in gaining a clear understanding of pertinent facts.

After a brief introduction the author begins with the economic cycle. From this he goes into Principles and Methods of Cost estimating. The first part of Chapter IV considers the problem of *interest* and its importance in value estimations. The second part of Chapter IV includes discussions of how the book value of machines and structures change. Several points of view are included along with some well known methods of accounting for depreciation. The *current* practice as reported by Professor Wyman P. Fiske, of the Massachusetts Institute of Technology, and William Gardner Borker, II, of Lever Brothers Company, Cambridge, in the *Controller* of January 1938 is also included.

The question of "economic worth" (Chapter V) of a Capital

asset and the determination of relative economic worth is explained and illustrated with problems by two methods. An adaptation of Lord Kelvin's well known law for economical cross-section of electrical conductors, is applied here to the replacement of productive equipment.

"The economic characteristic of business enterprise" (Chapter VI) is discussed under 21 subtopics including, "break-even chart" with a typical example, "the influence of plant design" and "the problem of dumping."

"The economic characteristics of typical American businesses" (Chapter VII) is thoroughly discussed via the "break even" chart which is applied to typical industries including, automobile, steel, food products, electrical manufacturers, restaurants, department stores, miscellaneous businesses and the Utilities.

The balance sheet and profit and loss statements are discussed (Chapter VIII) under the heading "The interpretation of financial statements."

The closing chapter considers the "business enterprise on a national scale." Subtopics include Employment; Production; Purchasing Power; Production and Income; the costs of Production and Merchandising; and general conclusions.

At the close of each of the first eight chapters from 4 to 12 problems are included. There is a total of 54 such problems in the book. At the end of the book 10 pages of Bibliography and 5 pages of index are also included.

This volume is a worthwhile addition to the literature in the field of business administration and some of the material can well be applied to the field of engineering.

R. C. GORHAM

The Principles of Metallographic Laboratory Practice. GEORGE L. KEHL, Instructor in Metallurgy, Lehigh University. Published by the McGraw-Hill Book Company, New York, 1939. Price $3.50.

I have read this new text with much interest. Mr. Kehl has presented in rather compact form much of the material which the laboratory worker formerly needed to hunt out from a considerable number of sources and often at the cost of considerable time.

The headings of the nine chapters will give an idea of the range of detail considered in the text: preparation of specimens for microscopic examination; etching of specimens for microscopic examination; metallurgical microscopes and photomicrography; the principles of photography; macroscopic examination of metals; hardness testing; special metallurgical tests; the principles of

pyrometry and pyrometric practice; thermal analysis. The above takes up some 291 pages; and 47 pages of appendices contain tabulated data on the following items: etching reagents; photographic formulae; the S. A. E. steel specifications; hardness numbers; spark characteristics of steels; and pyrometric data.

As the title indicates, the text combines the presentation of principles with descriptions of actual laboratory practice. It is a good text, carefully written, and well illustrated; and should prove of much value, especially to younger workers.

It seems to the present reviewer that the author might well have included a chapter on X-ray and radiographic practice. Magnetic testing also might well have been more thoroughly treated. However, it is certainly desirable to keep the price of such books within the means of technical students and this sets a limit on the size permissible. The choice and treatment of the subjects included in this text are such as to make the new book a welcome addition to our metallurgical literature.

S. L. GOODALE

Mine Examination and Valuation. Second Edition. CHARLES H. BAXTER, Professor of Mining Engineering and Economics, and ROLAND D. PARKS, Associate Professor of Mining Engineering, Michigan College of Mining and Technology. Houghton, Mich., Michigan College of Mining and Technology, 1939. 331 pages. $3.50.

The first edition of this work was reviewed in the JOURNAL of June, 1933. Although changes and rearrangements are evident throughout, sufficient to give a net increase of fifteen pages, the differences in general are of minor importance and have not altered the book materially.

Part I treats sampling, examination and mine economics, all from the standpoint of ore mining. Part II covers valuation with special reference to mining properties. Part III is a set of valuation tables based on standard formulas and individually enlarged in the present edition to include a wider range of interest rates and to reduce interpolation. Graphs are added in some instances to duplicate material in tabular form.

The appendix describing the Michigan mine appraisal system is retained as a detailed example of mine taxation practice. The bibliography has been enlarged to include material appearing in the last six years.

Altogether, the new text maintains the standard of the first edition and, in matters of detail, improves upon that edition.

Metallurgy for Engineers. E. C. ROLLASON, M.Sc., Department of Metallurgy, University of Birmingham, published in May, 1939, by Edward Arnold & Co., London, and Longmans, Green & Co., New York. Price $3. 272 pages, 155 figures or illustrations.

The list of chapter headings suggests the general range of the text: as follows, I, Mechanical and Non-destructive Tests; II, The Macro-examination of Metals; III, Micro-examination; IV, Solidification of Metals; V, Equilibrium Diagrams and their Interpretation; VI, Deformation and Annealing of Metals; VII, Irons and Carbon Steels; VIII, Heat Treatment of Steels; IX, Alloy Steels; X, Corrosion Phenomena, Stainless and Heat-resisting Steels; XI, Cast Irons; XII, Cooper and its Alloys; XIII, Light Alloys; XIV, Miscellaneous Non-ferrous Metals and Alloys; XV, Metallurgical Aspects of Metal-joining; XVI, The Measurement of Temperature; Selected Bibliography; Index.

The preface states that: "The object of this book is to provide a condensed description of metallurgical theory and practice, both ferrous and non-ferrous now required by engineering students." And it seems to the present reviewer that the author has done this, and that the book admirably fits the needs of the engineer who should know enough about the engineering metals and alloys to understand the language of the metallurgical specialist; and be able to apply his advice or instructions to some specified problem.

"Metallurgy for Engineers" deals with the science—and with the arts of adapting metals and alloys to the many and growing uses of speeding technology. Many more metallurgical engineers—and scientists also—are now employed in this work of physical metallurgy, or metallography, and especially in research and development phases of it, than are employed in the work and development of extraction of metals from ores. The literature of these subjects has been expanded very rapidly, and so much of it is highly specialized and more or less controversial, and even verbose, that it is very desirable to have a brief, reliable text as a general guide for men who must use metals, but who are not specialists in metallurgy. In this new text a wide range of metallurgical subjects is discussed concisely and accurately, and the brevity of the treatment permits a surprisingly large amount of information to be included.

S. L. GOODALE

Analytic Geometry. ROSCOE WOODS. The Macmillan Company, 1939. xiii, 294 pp. Price $2.50.

This text is planned for the general first course in Analytic Geometry for colleges and technical schools. The material covered

is somewhat more than is usually included, but the arrangement is such that the text can easily be adapted to a shorter course. The first ten chapters include the essentials of the Plane Analytic Geometry. Chapters XI and XII are devoted to a more extensive discussion of conics: geometric properties, construction invariants, poles and polars, and diameters. These chapters provide ready reference material, but can be omitted entirely if desired. Chapters XIII to XV, inclusive, present an excellent introduction to the Solid Analytic Geometry, including all of the material needed for the Calculus. Here again the last of these chapters, dealing with surfaces and curves, may be omitted.

Throughout the book, the arrangement of topics is logical and the presentation of subject matter is clear and concise. Problems are numerous and have been chosen to provide practice and a wide range of applications. In particular, the chapter on curve tracing contains a list of equations of about forty curves, including many of the simpler higher plane curves. The abundance of well-chosen problems increases the value of the book as a text and for reference.

MARY T. SPEER

Vapor Charts and Special Tables for Turbine Calculations. FRANK O. ELLENWOOD and CHARLES O. MACKEY. John Wiley and Sons, Inc. 43 pages. $2.50.

Vapor charts are included for steam, dichlorodifluoromethane (freon-12), and ammonia. All charts are bound in a book of which the page size is approximately 8¼ inches by 10¾ inches. The diagrams are arranged so that specific volume, specific enthalpy, specific entropy, temperature, and absolute pressure may be read. Moisture content is also given in the case of saturated steam.

Steam data are given by 21 sectional charts and a master chart. The master chart aids in quickly finding the proper page for any desired conditions. The ranges for steam are 5,500 pounds per square inch to 0.18 inches of mercury absolute pressure, 0.05 to 3,500 cubic feet per pound specific volume, and 32 to 1,200 degrees fahrenheit temperature. Charts of specific volume versus enthalpy for water are given to an absolute pressure of 6,000 pounds per square inch and to a temperature of 705.4 degrees fahrenheit.

A psychrometric chart in three sections covers dry bulb temperatures from —40 to 350 degrees fahrenheit. Table of jet velocities for ideal nozzles, squares of numbers, and barometer corrections complete the book.

The consolidation of such data in a single book of convenient size makes it a valuable reference work for teacher, student, and practicing engineer.

Steam, Air, and Gas Power. Third Edition. WILLIAM H. SEVERNS and HOWARD E. DEGLER. John Wiley and Sons, Inc. 511 pages. $4.00.

This is a further revision of a well arranged and complete book for beginners in Heat Engineering. The authors have attempted to bring the subject matter up to date with respect to experimental data, design, and practice.

The steam tables, abridged from *Thermodynamic Properties of Steam* by Keenan and Keyes, have been located in the Appendix. The Mollier Diagram is now bound in the book rather than held loosely by the strip inside the back cover. This is an advantage as it will not be easily lost or cause the confusion of unfolding the larger charts in classroom work.

The Mollier Chart has been reduced to the size of two pages of the book. Constant superheat lines have been omitted. The same is true for constant pressure lines in inches of mercury. The constant pressure lines have been spread and the numerical pressure markings have been made both at the top and in the moisture region. The constant quality lines have been marked in terms of quality and not moisture content as formerly. These changes should make the chart much less confusing to the beginner.

The chapter on Principles of Thermodynamics has been revised and made rather complete. New illustrations of equipment have been used to a certain extent. The subject matter dealing with internal combustion engines has been amplified to include considerable discussion on diesel engine construction and application.

The reviewer has found the former edition of this book very useful as a text for elementary power plant courses.

Problems in Mechanics. G. B. KARELITZ, J. ORMONDROYD, and J. M. GARRELTS. The Macmillan Company. 271 pages. $2.50.

The authors have taken the very sensible viewpoint that problems in mechanics should illustrate the application of the principles to an actual machine or structure. This naturally has merit because it heightens the interest of the student and gives him practice in recognizing the principles that apply to any new or unfamiliar engineering problem.

The first 50 pages of the book are devoted to a concise exposition of the fundamental principles and laws of mechanics. This is followed by 782 practical problems. The exposition and problems are grouped into three general sections: Statics, Kinematics, and Kinetics.

Such a book would certainly be a help to any teacher of mechanics.